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PHYSICS ABSTRACTS

BEING

SCIENCE ABSTRACTS—SECTION A

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ABSTRACTS 2212-2501

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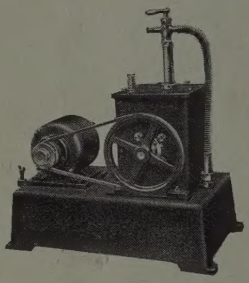

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MATHEMATICS

2212 511.142

The value of $\sqrt{2}$ given in the Śulvasutras. GURJAR, L. V. *J. Univ. Bombay*, 10, *pp.* 6–10, *March*, 1942.

2213 511.52

Certain congruence criteria connected with Fermat's last theorem. VANDIVER, H. S. *Proc. Nat. Acad. Sci., Wash.*, 28, *pp.* 144–150, *April*, 1942.

2214 511.83 : 513.494

The problem of squaring the circle as solved in the Śulvasutras. GURJAR, L. V. *J. Univ. Bombay*, 10, *pp.* 11–16, *March*, 1942.

2215 511.92

Product with super-wonderful demlo-numbers. CHANDRATREYA, M. L., AND KAPREKAR, D. R. *J. Univ. Bombay*, 10, *pp.* 1–5, *March*, 1942.

2216 512.831 : 513.82

The geometry of matrices. TURNBULL, H. W. *Philos. Trans.*, 239 A, *pp.* 233–267, *June* 30, 1942.—The matrix notation and theory of the stratified locus V_k^k are developed, and two reflexive processes are defined. A matrix pencil is interpreted by means of Grace's collineation defined by four $[k-1]$'s in $[2k-1]$. A non-singular matrix pencil is interpreted in terms of reflexive operations. These lead to rational normal loci and their osculating systems. The minimal indices of a singular pencil, the minimal vectors and latent loci are discussed.

2217 512.897

On generalized biorthogonal expansions in metric and unitary spaces. TSENG, Y. Y. *Proc. Nat. Acad. Sci., Wash.*, 28, *pp.* 170–175, *May*, 1942.

2218 513.311

Bisector planes of the angles between two given planes. WANI, K. N. *J. Univ. Bombay*, 10, *pp.* 29–30, *March*, 1942.

2219 513.346

Properties of mutually selfpolar tetrahedra. MAÑDAN, S. R. *Bull. Calcutta Math. Soc.*, 33, *pp.* 147–155, *Dec.*, 1941.—An account of mutually selfpolar tetrahedra as a generalization of mutually selfpolar triangles.

2220 513.346 : 513.624.82

On mutually selfpolar tetrahedra. HAMEED, A. *Bull. Calcutta Math. Soc.*, 33, *pp.* 157–186, *Dec.*, 1941.—A development of properties of selfpolar triangles into 3 dimensions.

See Abstr. 2214 513.494 : 511.83

See Abstr. 2220 513.624.82 : 513.346

2221 513.736.9

On a class of surfaces. FUBINI, G. *Proc. Nat. Acad. Sci., Wash.*, 28, *pp.* 178–185, *May*, 1942.—Deals with the problem of differential projective geometry of finding all the surfaces S which possess at least 2 systems of curves such that the curves of the same system are projective to each other.

See Abstr. 2216 513.82 : 512.831

2222 513.821

The tortuosity of submanifolds of a variety. GHOSH, N. N. *Bull. Calcutta Math. Soc.*, 33, *pp.* 187–195, *Dec.*, 1941.—Continues investigations on properties relating to the osculating and the normal subspaces of a general variety immersed in an Euclidean hyperspace.

2223 513.88

Representation of one-parameter semi-groups of linear transformations. HILLE, E. *Proc. Nat. Acad. Sci., Wash.*, 28, *pp.* 175–178, *May*, 1942.

2224 517.22

A note on differentiability. HEBALKAR, G. K. *J. Univ. Bombay*, 10, *pp.* 31–34, *March*, 1942.

2225 517.564

Differentially cyclical sets of functions. An extension of the concept of hyperbolic functions. SILBERSTEIN, L. *Phil. Mag.*, 33, *pp.* 457–461, *June*, 1942.

2226 517.942.8

Asymptotic solutions of linear differential equations. JEFFREYS, H. *Phil. Mag.*, 33, *pp.* 451–456, *June*, 1942.—Approximate solutions of certain types of differential equations, applicable to Mathieu functions, are related directly to the Airy integral and its companion function.

See Abstr. 2302 518.3 : 535.241.41 : 628.9

See Abstr. 2306 518.3 : 535.316

2227 518.41

Common empirical equations. ESPY, D. *Communications*, 22, *pp.* 8, 11, 30 *and* 31, *Feb.*, 1942.—Summarizes usual forms $y = Ax + B$, $y = Ax^n$, $y = Be^{ax}$, $y = (Ax + B)/x$, $y = x/(Ax + B)$, $y = A + Bx^2$, $y = Ax^2 + Bx + C$, which by plotting x *v.* y, $(\log x)$ *v.* $(\log y)$, x *v.* $(\log y)$, x *v.* xy, x *v.* (x/y), x^2 *v.* y, x *v.* (Δy), respectively, give straight-line checks. For finding the const., aggregation of points to give an appropriate number of simultaneous equations is suggested—with some modification if some of the points are notably inexact on comparison. G. F. F.

2228 519.12

Arrangements with given number of neighbours. CHANG, T. S., AND HO, C. C. *Proc. Roy. Soc. A.*, 180, 982, *pp.* 345–365, *June* 5, 1942.—A method previously employed [Abstr. 4433 (1939)] to find the number $p(N, n, X)$ of ways of arranging nB particles on N points on a straight line while producing X pairs of BB nearest neighbours is extended to find the number of ways of arranging given numbers of $A, B, C, \ldots$ particles on N points lying in a number of parallel planes containing in each a finite number of points while producing given numbers of various kinds of neighbours (such as the nearest neighbours, the next nearest neighbours, etc.) formed by different pairs of particles. The number of ways of arranging nB particles on 2 rows of points while producing X pairs of BB nearest neighbours is investigated in detail, and the results plotted.

2229 519.27 : 620.11

Sampling and probability. PARSONS, R. H. *Engineer, Lond.*, 173, *pp.* 528–529, *June* 26, 1942.

2230 519.281

On the significance tests for the introduction of new functions to represent measures. JEFFREYS, H. *Proc.*

Roy. Soc. A, 180, 982, *pp.* 256–268, *June* 5, 1942.—Significance tests have been derived as approx. formulae [Abstr. 1832 (1938)]. The exact formulae are reduced to single integrals involving only the number of observations and one function of the measured values, and their evaluation is carried out. The approx. formulae are as accurate as we need when the number of observations exceeds the number of unknowns by about 6, but the extended calculation also gives the results when the difference is smaller. An approx. treatment is given for the case where the normal equations for 2 harmonics are not orthogonal in the coeff. and the weights unequal.

2231 519.283

Studies in educational statistics: 0 (introduction). SHINTRE, R. P. *J. Univ. Bombay*, 10, *pp.* 17–28, *March*, 1942.—[See Abstr. 2012 (1942)].

See Abstr. 2233 519.283 : 521.11

2232 519.444

Certain direct products of the groups of self-isometries. MILLER, G. A. *Proc. Nat. Acad. Sci., Wash.*, 28, *pp.* 141–144, *April*, 1942.

See Abstr. 2478 519.47 : 539.152 : 539.3 : 548.7

ASTRONOMY. GEODESY

2233 521.11 : 519.283

The statistics of the gravitational field arising from a random distribution of stars. I. The speed of fluctuations. CHANDRASEKHAR, S., AND NEUMANN, J. VON. *Astrophys. J.*, 95, *pp.* 489–531, *May*, 1942.—A statistical analysis of the speed of the fluctuations in the gravitational field, acting at some fixed point in a system containing a random distribution of mass centres (stars) in motion. The solution depends on the evaluation of the moment of a certain bivariate distribution giving the probability of a force per unit mass acting at a point and a simultaneous rate of change of the force. The statistical problem has been solved on the assumptions of a spherical distribution of the velocities and a random spatial distribution.

See Abstr. 2256 521.11 : 523.85

See Abstr. 2257 521.11 : 523.852.3

2234 521.116 : 523.855

The dynamics of the interstellar medium. III. Galactic distribution. SPITZER, JR., L. *Astrophys. J.*, 95, *pp.* 329–344, *May*, 1942.—[See Abstr. 2524 (1941)]. The equilibrium of a gas in the gravitational field of a galaxy is considered by estimating the ratio of the random stellar velocities to the velocities of the interstellar particles. This ratio is found to be about 10 for elliptical galaxies of mass 10^{10} times that of the Sun, so that any interstellar matter in such systems in equilibrium must be concentrated much more closely to the equatorial plane than the stars. If the mass of interstellar matter exceeds that of the stars, half of it is found to lie within 3 parsecs of the equatorial plane. In any case the light observed must be direct starlight, not diffuse or scattered light. The effect which a thin, dense layer of dark matter can produce on the stellar distribution in a galactic system is examined, and a comparison with observational data n NGC 3115 suggests that this nebula may contain such a layer. A. HU.

2235 522.1

The astrophysical observatory of the California Institute of Technology. ANDERSON, J. A. *J. Roy. Astr. Soc. Can.*, 36, *pp.* 177–200, *May–June*, 1942.—The author describes in detail the design, construction and erection of the offices, workshops and laboratories at Pasadena, and of the 200 in. telescope and smaller observing units on Mt. Palomar. A. HU.

See Abstr. 2376 522.41 + 531.74 + 531.76 + 538.74] : 527.6

2236 523.11

Origin of the solar system. JEANS, J. H. *Nature, Lond.*, 149, *p.* 695, *June* 20, 1942.

2237 523.161

Reports on the progress of astronomy. Interstellar matter. BEALS, C. S. *Mon. Not. Roy. Astr. Soc.*, 102, 2, *pp.* 96–106, 1942.—Recent work on the problem of solid particles in interstellar space is reviewed, special attention being given to the general and selective absorption caused, and to the probable frequency distribution of particle sizes. The presence of interstellar gas is known by the appearance of atomic emission and absorption lines and of molecular absorption lines. Evidence on the ionization level in interstellar space is reviewed, and various estimates of the densities of the various gaseous constituents are compared. A. HU.

See Abstr. 2311 523.162 : 535.338.4

See Abstr. 2491 523.4 : 551.510

2238 523.51

A remark on meteors. STERNE, T. E. *Astrophys. J.*, 95, *pp.* 437–440, *May*, 1942.—Preliminary estimates of 2 000 000° for the highest temperature reached in a meteor moving at 60 km./sec. through air initially at 180° abs. and of 70 000° after the air's subsequent expansion are excessive because of the lowering by dissociation and ionization of the effective ratio of sp. hts.

2239 523.531

Meteors photographed with the 18 in. Schmidt camera on Mt. Palomar. WATSON, F. *Pop. Astr.*, 50, 3, [3 *pp.*], *March*, 1942.—Meteor trails are examined on the supernova patrol films taken on the *f*/2 Schmidt camera on Mt. Palomar. On 394 films with a total exposure of 10 663 min., 81 trails are found: the time interval per meteor is tabulated for the various emulsions. The diurnal and annual variations and the effect of zenith distance are exhibited in tables. Comparison with frequencies found from visual observations shows that the faintest meteors recorded are between magnitudes 2 and 3. A. HU.

2240 523.61

Reports on the progress of astronomy. Comets. DAVIDSON, M. *Mon. Not. Roy. Astr. Soc.*, 102, 2, *pp.* 107–108 *and* 109, 1942.—[See Abstr. 1746 (1940)].

2241 523.72

The source of the Sun's energy. CHAPMAN, S. *Mon. Not. Roy. Astr. Soc.*, 102, 2, *pp.* 110–130, 1942.—The Presidential Address to the Royal Astronomical Society: a semi-popular account from first

principles of the nuclear reactions involved in energy generation in the Sun's interior. A. HU.

2242 523.74

Reports on the progress of astronomy. Solar activity. NEWTON, H. W. *Mon. Not. Roy. Astr. Soc.*, 102, 2, *p.* 108, 1942.

2243 523.75 : 550.385

A solar eruption and the magnetic storm of 1942 March 1–2. NEWTON, H. W. *Observatory*, 64, *pp.* 260–264, *June*, 1942.—Solar and geophysical data relating to the great sunspot of Feb. 22–Mar. 7, 1942, are given in outline. The chromospheric eruption of Feb. 28·5 was of abnormal duration (3½ hr.), intensity, and extent; and was accompanied by a simultaneous short-wave radio fade-out of unusual duration and a magnetic disturbance of exceptional amplitude. A great magnetic storm which began 19½ hr. later showed 27 unique regular pulsations in *H* and *V*. It is suggested that the chromospheric eruption initiating these phenomena was a multiple one. A. HU.

2244 523.8

The central density of the stars. KOPAL, Z. *Astrophys. J.*, 95, *pp.* 569–570, *May*, 1942.—[See Abstr. 1460 (1942)].

2245 523.838

On stellar rotation. SCHWARZSCHILD, M. *Astrophys. J.*, 95, *pp.* 441–453, *May*, 1942.—The general problem of stellar rotation is discussed, and a special formulation, taking account of the viscous forces in a restricted form, is given. The corresponding equations are set down, and the first-order perturbation method for their solution is discussed. For the special case of the standard model in slow rotation the equations are given and solved. The solution is found to be unique and to correspond to a solid-body rotation.

2246 523.838

On the rotation of stars with convective core. RANDERS, G. *Astrophys. J.*, 95, *pp.* 454–460, *May*, 1942.—The convection in the central core of a rotating star is investigated. It is shown that even an extremely slow rotation has the effect of making the turbulent convective motion take place preferentially in a direction parallel to the axis of rotation. As a consequence, the energy from the central sources is being transported through the convective core mainly toward the poles. The resulting polar heating in the main body of the star leads to an increase of the rot. velocity toward the equatorial plane.

2247 523.838 : 523.841.9

The calculation of rotation factors for eclipsing binary systems. KOPAL, Z. *Proc. Nat. Acad. Sci., Wash.*, 28, *pp.* 133–140, *April*, 1942.—Analytical formulae are set up for computing the rotation factors required for interpreting the spectroscopic rotation effect in eclipsing binaries. The formulae are exact for uniformly bright or limb-darkened undistorted components rotating like rigid bodies about axes perpendicular to the orbital plane. The factors are expressible in terms of the same functions that are required for an analysis of light changes of eclipsing variables and depend on 2 independent parameters which can be tabulated for any particular phase of the eclipse. A. HU.

2248 523.841

A semi-regular variable in Messier 4. SAWYER, H. B. *J. Roy. Astr. Soc. Can.*, 36, *pp.* 213–217, *May–June*, 1942.—A Julian day plot of the light variations of Variable No. 4 in M 4 is given for observations between 1893 and 1921. The period is irregular, of length about 50 days; the range varies, as well as the magnitude at max. and min. The star most resembles the UU Herculis type. The evidence is insufficient to decide whether it is a member of the cluster. A. HU.

2249 523.841.11

Spectral stages of novae. MCLAUGHLIN, D. B. *Astrophys. J.*, 95, *pp.* 428–436, *May*, 1942.—Systems of absorption and emission lines in the spectrum of a typical nova are briefly enumerated and described. Criteria for assignment of a nova spectrum to stages of development are defined in terms of (1) emergence, max. strength and disappearance of each absorption system and (2) intensity ratios of certain pairs of emission bands. Spectra of 7 bright novae have been examined in detail. Dates and differences of magnitude from max. light are tabulated for each of 26 spectral stages, and these are combined into a table of chronology of a typical nova spectrum. Some deviations of individual objects from the average and some differences between rapid and slow novae are discussed briefly. [See Abstr. 3464 (1937)].

2250 523.841.2.035.922.1

Luminosities of the M-type variables of small range. KEENAN, P. C. *Astrophys. J.*, 95, *pp.* 461–467, *May*, 1942.—Spectroscopic luminosity classes and abs. magnitudes have been determined for 67 semi-regular or irregular variable stars of types K and M. These are stars for which the amplitude of the light-variation is less than 2 mag. The visual abs. magnitudes range from zero (normal giants) to − 5 or − 6, but the stars are not uniformly distributed over this interval; 13 are brilliant supergiants of types K5–M3, while the remainder are of lower luminosity. Irregular variability appears uncommon among early M-type giants. The supergiant variables are concentrated near the galactic plane and show a pronounced grouping in longitude. Five are members of the double cluster, *h* and χ Persei. Several of the supergiants recognized in this survey are among the most luminous stars known. One of them, RW Cep, is probably brighter than μ Cep.

See Abstr. 2262 523.841.3 : 523.872

2251 523.841.9

Notes on eclipsing variables. RUSSELL, H. N. *Astrophys. J.*, 95, *pp.* 345–355, *May*, 1942.—The problem of determining the elements of an eclipsing variable from photometric data is considered. Preliminary elements should represent the whole light-curve and include ellipticity, reflection, orbital eccentricity (if present) and limb darkening; corrections for difference in shape and gravity effect may then be made from tables, and least-squares solutions derived. A nomogram is given for the solution of partial eclipses of uniform discs. The tables for "completely darkened" circular discs are exactly applicable to eclipses of similar ellipsoids upon which the coeff. of darkening is 1 and that of the gravity effect ¼. For actual ellipsoidal stars corrections for

non-uniform brightness over the surface are necessary in accurate work. A. HU.

2252 523.841.9

Absolute dimensions of a Wolf–Rayet star and the expanding-envelope hypothesis. WILSON, O. C. *Astrophys. J.*, 95, *pp.* 402–420, *May*, 1942.—New observational data are used to determine the abs. dimensions of the eclipsing variable HD 193576. The system consists of a Wolf–Rayet star and a B-type star, the former being larger and brighter but less massive than its companion. The fact that the Wolf–Rayet star is subjected to a large orbital acceleration makes it possible to test the hypothesis that the emission bands originate in an expanding shell, since the radial velocity measured by the displacement of the emission bands will be out of phase with that given by the star itself. An investigation of this "transit-time" effect in a system of these dimensions throws grave doubts on the expanding-envelope hypothesis. Possible alternative explanations of the band contours are examined, but no satisfactory solution is found. A. HU.

See Abstr. 2247 523.841.9 : 523.838

2253 523.842

Reports on the progress of astronomy. Double stars. BOS, W. H. VAN DEN. *Mon. Not. Roy. Astr. Soc.*, 102, 2, *p.* 109, 1942.

2254 523.842 : 523.874

The spectrographic orbit of the companion to Rigel. SANFORD, R. F. *Astrophys. J.*, 95, *pp.* 421–424, *May*, 1942.—The orbit of the companion of Rigel has been determined from 18 spectrograms with a dispersion of 10 Å/mm. This orbit differs little from a circle. The period is 9·860 days; the ratio of the masses of the 2 components, $m_2/m_1 = 0{\cdot}767$; $(a_1 + a_2) \sin i = 7{\cdot}771 \times 10^6$ km.; and the centre of mass velocity, $\gamma = +19{\cdot}1$ km./sec. No satisfactory reconciliation of the double-star observations with the spectroscopic orbit seems possible at present.

2255 523.842.3

The spectrographic orbit of 42 Capricorni. SANFORD, R. F. *Astrophys. J.*, 95, *pp.* 425–427, *May*, 1942.—Twenty-nine additional velocities, together with 59 already published, furnish a new set of mean elements of 42 Capricorni. Fourteen of the velocities were obtained from 13 to 18 years later than the velocities upon which previous sets of elements have been based. The new elements are in good agreement with those of Spencer Jones. The mean residuals seem to bear out his conclusion that the velocity of the system varies, perhaps in a period as long as 30 years.

2256 523.85 : 521.11

On the clustering of nebulae. I and II. ZWICKY, F., KATZ, L., AND MULDERS, G. F. W. *Astrophys. J.*, 95, *pp.* 555–568, *May*, 1942.—The spatial distribution of nebulae is analysed by 3 methods, with a view to testing the validity of Newton's law of attraction in intergalactic space. Method A subdivides space into cells of equal size: counts from the Shapley–Ames catalogue show that the probability that the observed distribution is a random one is $1/420 \times 10^6$, i.e. that the nebulae cluster according to organized forces, whose exact form cannot, however, be decided by this method. Method B is concerned with the frequency distribution of clusters of nebulae: it shows that bright nebulae and those of the globular and elliptic type show a greater tendency towards clustering than faint nebulae and spiral nebulae, respectively. Method C analyses the morphology of individual clusters: the radial distribution in the Coma cluster can be represented by Emden's distribution curve for a bounded gravitational isothermal gas sphere, thus verifying the applicability of Newton's law at distances of millions of light years. [See Abstr. 2257 (1942)]. A. HU.

See Abstr. 2264 523.852 : 523.873

2257 523.852.3 : 521.11

On the physical characteristics of the Hydra cluster of nebulae. ZWICKY, F. *Proc. Nat. Acad. Sci., Wash.*, 28, *pp.* 150–155, *April*, 1942.—The radial distribution of nebulae in the Hydra cluster is found to agree with that in the Emden bounded gravitational gas sphere. The observed structural index of the cluster is used to determine the average mass of the nebulae on various assumptions of velocity dispersion. The central density of the cluster is about 10^5 times the density of the general field. [See Abstr. 2256 (1942)]. A. HU.

2258 523.854.2

The true galactic pole. WALKEY, O. R. *Observatory*, 64, *pp.* 264–273, *June*, 1942.—The author gives an historical review of the determinations of the position of the galactic pole and of the various proposals for the point of zero galactic longitude. Twenty determinations of the pole are tabulated and plotted according to the methods used: by the galactic belt (7), by star counts (4), or by galactic objects (9). The mean of the determinations, whether simple or reasonably weighted, gives the true position for epoch 1900 as R.A. 192°, Dec. + 27°. A. HU.

See Abstr. 2234 523.855 : 521.116

2259 523.872

On the P Cygni characteristics of H.D.190073 and the dimensions of its emitting and absorbing shells. BEALS, C. S. *J. Roy. Astr. Soc. Can.*, 36, *pp.* 145–157, *April, and pp.* 201–212, *May–June*, 1942.—The Balmer-line profiles of this spectrum variable are interpreted as due to an underlying reversing layer giving broad absorption lines similar to those in ordinary early-type stars, together with a large envelope of outward-moving atoms giving rise to P Cygni-type emissions superposed on the absorption lines. Self-reversal probably occurs in this envelope. The peculiar Ca II profiles are also interpreted in terms of an envelope of ejected atoms, the emission components being subject to self-absorption taking place at great distances from the stellar surface. Numerical values are deduced for the radii of the various H and Ca II shells. A. HU.

2260 523.872

The occurrence of carbon isotopes in the spectra of *N*-type stars. SHAJN, G. *Observatory*, 64, *pp.* 255–259, *June*, 1942.—The results of a search for isotope bands in different sequences of the Swan bands in the spectra of *N*-type stars are given in tabular form. Seven new bands due to $C^{13}C^{12}$ are identified and microphotometric measures made for determining the abundance ratio $C^{13}C^{12} : C^{12}C^{12}$, which is estimated at from 0·1 to 1·0, the range being due possibly to a range of 0·05 to 0·50 in the abundance

ratio $C^{13} : C^{12}$ or perhaps to a difference of excitation in the various stars. In any case a high relative abundance of $C^{13}C^{12}$ molecules is observed, suggesting that Bethe's cyclic reaction is not realized in type *N* stars. A. HU.

2261 523.872

The spectrum of BD + 11°4673 during the years 1937–1941. MERRILL, P. W. *Astrophys. J.*, 95, *pp.* 386–401, *May*, 1942.—[See Abstr. 4194 (1932)]. The bright lines of H have been wider and more intense than formerly. The 800-day cycle in the displacements has continued with little change of phase, but the amplitude and the mean velocity have become smaller. The amplitude reached a max. in 1928. The chief lines of He I have remained prominent. Singlets and triplets behave differently. The negative displacements of the dark components are now greater than at any other time. Of special interest is the increasing intensity of λ4 686 He II. The dark bands of TiO have gradually grown stronger, until in 1940 and 1941 their intensities were approx. equal to those in class M1. Progressive changes since 1915 include strengthening and widening of bright lines of H and He I; increasing negative displacements of dark lines; a general increase in the ionization of the atmosphere. The hypothesis of an expanding atmosphere is briefly discussed. Certain facts suggest that the velocities of atoms increase as they travel outward and that the degree of ionization also increases.

2262 523.872 : 523.841.3

Spectrographic observations of 17 Leporis. SMITH, B., AND STRUVE, O. *Astrophys. J.*, 95, *pp.* 468–488, *May*, 1942.—Spectrographic observations (142) were secured at the Yerkes Obs. from 1928 to 1942; 9 violent outbursts of nova-like character have been observed. Each disturbance is characterized by the appearance of violet components to the normal absorption lines, which themselves show velocities of expansion corresponding to betw. 60 and 30 km./sec. The outbursts repeat themselves at intervals of approx. 150 days, but the phenomenon is not periodic. The lines of Mg II and Si II show radial velocities averaging approx. + 20 km./sec. The strongest metallic lines have a tendency to show weak emission borders on their red sides. There are marked variations in the intensities and widths of the absorption lines during the normal stage of the star.

2263 523.873

Term analysis of the third spectrum of iron (Fe III). EDLÉN, B., AND SWINGS, P. *Astrophys. J.*, 95, *pp.* 532–554, *May*, 1942.—The Fe III spectrum has been measured from approx. 500 Å to 6 500 Å and its analysis has been carried as far as the observational data permit.

2264 523.873 : 523.852

The spectra of ten gaseous nebulae. WYSE, A. B. *Astrophys. J.*, 95, *pp.* 356–385, *May*, 1942.—Observations of faint nebular lines [Abstr. 667 (1940)], have been extended to include 9 planetaries and the Orion nebula. Wavelengths, estimated intensities and probable identifications are tabulated. Apart from merely suspected lines, the table includes, in the region between 3 700 and 6 750 Å, about 270 lines, approx. 60% identified. Additional evidence is found for the existence of metallic elements in the nebulae. All the objects observed appear to be closely similar in chemical composition. The observations confirm earlier conclusions.

See Abstr. 2254 523.874 : 523.842

See Abstr. 2376 527.6 : [522.41 + 531.74 + 531.76 + 538.74

PHYSICS: GENERAL

2265 530.1

Newtonian mass, its definition and determination. DRAPER, G. H. *Phil. Mag.*, 33, *pp.* 476–478, *June*, 1942.

2266 530.12 : 531.51

A relativity query. HOUSTOUN, R. A. *Nature, Lond.*, 150, *p.* 25, *July* 4, 1942.—The deflection of light rays passing near the sun and the advance of Mercury's perihelion are given simply by Fermat's principle and the principle of least action, respectively.

See Abstr. 2347 530.12 : 536.791.2

2267 530.19 : 538.522 : 621.3.011.3

The vector potential and inductance of a circuit comprising linear conductors of different permeability. HIGGINS, T. J. *J. Appl. Phys.*, 13, *pp.* 390–398, *June*, 1942.—[Abstr. 1153 B (1942)].

2268 531.19

Note on statistical forces. GOLDSTEIN, L. *J. Chem. Phys.*, 10, *pp.* 295–297, *May*, 1942.—It is shown that a 2-particle force acting in co-ordinate space represents with a good approximation the apparent coupling in space between 2 spinless atoms of ideal symmetrical or antisymmetrical assemblies at all temperatures higher than, or equal to, their transition temperature.

2269 531.19

Statistical mechanics of binary mixtures. ALFREY, T., AND MARK, H. *J. Chem. Phys.*, 10, *pp.* 303–304, *May*, 1942.—The configurations of a binary mixture are described by specification of the occupants of a reference set of lattice point pairs, rather than by specification of the occupants of each individual lattice point. If the total interaction energy can be expressed as the sum of terms due to nearest neighbour pairs, the configurational partition function can be derived directly.

2270 531.224/226

Some practically important stress-systems in solids of revolution. SOUTHWELL, R. V. *Proc. Roy. Soc. A*, 180, *pp.* 367–396, *July* 3, 1942.—The "semi-indirect" method of Saint Venant is applied to determine directly (i.e. without explicit reference to strains) distributions of stress in complete solids of revolution (e.g. twisted shafts of non-uniform diameter, axially symmetrical systems such as pressure vessels) and in incomplete tores (e.g. helical springs of small pitch, beams of large curvature and hooks). The paper is intended as a prelude to approx. but general treatment by relaxation methods; consequently only simple examples are considered, but a comparison is made with earlier solutions less suited to a "relaxation" approach.

See Abstr. 2266 531.51 : 530.12

2271 531.537

The double torsion pendulum in a liquid. YU YEE-TAK. *Amer. J. Phys.*, 10, *pp.* 152–153, *June*, 1942.—A simple demonstration apparatus.

See Abstr. 2376 531.74 + 531.76 + 522.41 + 538.74] : 527.6

See Abstr. 2381 531.756 : 537.226.2 : 539.133

See Abstr. 2461, 2462 531.756 : 541.25

See Abstr. 2376 531.76 + 522.41 + 531.74 + 538.74] : 527.6

2272 531.787.2

A photo-electric membrane manometer. GILSON, W. E. *Science*, 95, *pp.* 513–514, *May* 15, 1942.—Minute heart beats in the turtle and the dog may be recorded by the insertion of a needle operating a diaphragm in the measuring unit nearby; a small mirror is moved by the diaphragm and a light beam reflected from it to a photocell, the output of which may be amplified and recorded as desired. Means for calibration by a Hg column are provided. The sensitivity is such as to show a pressure change of 1 mm. Hg. E. H. W. B.

2273 531.787.2 : 535.417

Membrane interferometer manometer. TOBIAS, J. M. *Rev. Sci. Instrum.*, 13, *pp.* 232–233, *May*, 1942.—A sensitive indicator of pressure change has been constructed which utilizes a thin organic film as one of a pair of interferometer reflectors. Displacement of the film with respect to a fixed glass plate results in a shift of interference fringes.

2274 532.13

Frictional phenomena. V–VI. B. Liquids. GEMANT, A. *J. Appl. Phys.*, 12, *pp.* 827–836, *Dec.*, 1941, *and* 13, *pp.* 22–29, *Jan.*, 1942.—Theories of liquid viscosity are reviewed. Experimental material is presented, on the effect of chemical constitution, temperature, pressure and mixture ratio on viscosity, which effect is explained on the basis of existing theories. Methods of measurement are described.

2275 532.13 = 3

Solutions with anomalous viscosity. BOEDEKER, K. *Kolloid Z.*, 94, *pp.* 161–163, *Feb.*, 1941.—Aq. solutions of alkylphenol-polyglycol-ethers show an anomalous rise of viscosity when heated. Beyond a certain temperature the solutions are separated into 2 liquid phases. The viscosity/conc. curve shows a max. for certain values of conc. The behaviour is explained by a combined action of solvatation and immobilization of the water of solution which may be caused by the formation of a network of the molecular chains. An analogy exists between this behaviour and that of aq. solutions of methylcellulose, and is also observed when certain electrolytes are added. R. N.

2276 532.13 = 3

Viscosity relations in concentrated solutions of synthetic aniline-formaldehyde resins. SCHEELE, W., STEINKE, L., AND AVISIERS, I. *Kolloid Z.*, 94, *pp.* 294–310, *March*, 1941.—Previous investigations [Abstr. 905 (1941)] are extended to solutions of higher conc. for which the linear viscosity/conc. relation is replaced by a curve with increasing slope. The results of recent measurements are given and discussed [see Abstr. 386 (1942)]. R. N.

See Abstr. 2285 532.13 : 532.74

2277 532.13 : 541.18 : 539.216.1

Frictional phenomena. VII–VIII. B. Liquids. GEMANT, A. *J. Appl. Phys.*, 13, *pp.* 90–96, *Feb., and pp.* 210–221, *April*, 1942.—The increase of viscosity of a solvent due to the presence of colloidal particles is discussed, and Einstein's equation is considered. The modification of the theory for elongated particles is discussed, and the theory is applied to polymers of fibre structure. Information concerning the shape of molecules of synthetic plastics can be obtained from determinations of viscosity of colloidal solutions of these polymers. In the case of gels, viscosity varies with stress, and is called structural viscosity. When there is stationary flow, shear and stress do not vary linearly. There is a relaxation process for suddenly applied stresses or deformations, and for vibrational processes the dynamic viscosity is dependent on frequency. The chief experimental facts are presented. A. J. M.

See Abstr. 2455 532.13 : 541.182.6

2278 532.13 : 621.315.615

Frictional phenomena. IX. B. Liquids. GEMANT, A. *J. Appl. Phys.*, 13, *pp.* 290–299, *May*, 1942.—[Abstr. 1198 B (1942)].

2279 532.13 : 621.89

Frictional phenomena. X. Lubrication. GEMANT, A. *J. Appl. Phys.*, 13, *pp.* 355–360, *June*, 1942. [Abstr. 1290 B (1942)].

2280 532.525

The turbulent spreading of a water jet. BINNIE, A. M. *Engineering*, 153, *pp.* 503–504, *June* 26, 1942.—The turbulent spreading of a jet of water projected into a stationary mass of water is investigated photographically. The mixing zone was found to be conical over a considerable distance. The core of potential flow was broadened a little distance below the surface of the stationary mass of water. The experimental results are compared with deductions from Kuethe's analysis [Abstr. 4472 (1935)]; moderate agreement is found between experimental and theoretical values of the core length. [See Abstr. 2267 (1938)]. J. S. G. T.

2281 532.582.4

The drifting force on a ship among waves. HAVELOCK, T. H. *Phil. Mag.*, 33, *pp.* 467–475, *June*, 1942.—The problem considered is the drifting force on a ship when head-on to a regular train of waves. A steady average drifting force is obtained depending upon the phase differences between the heaving and pitching motions and the periodic forces and couples due to the wave motion. An examination is made of experimental results and, although available data are not suitable for detailed comparison, it appears that the calculations give drifting forces of the right order of magnitude.

See Abstr. 2476 532.614.2 : 539.11 : 548

2282 532.62

Determination of the drying rate of thin films. REIGER, G., AND GROVE, JR., C. S. *Industr. Engng Chem.* (*Analyt. Edit.*), 14, *pp.* 325–333, *April* 15, 1942.—An air-damped chemical balance has the shadow of a fine pointer projected on a scale. The progressive decrease in weight of a drying film, such as of nitro-cellulose, is read on the scale at intervals as

required. Curves may be plotted to give the result in various forms. E. H. W. B.

2283 532.712 = 3

On the theories of osmotic pressure. METCALF, W. V. *Kolloid Z.*, 94, *pp.* 157–161, *Feb.*, 1941.—The objections raised by Thiel [Abstr. 398 (1942)] against the pressure-balance theory are discussed. For the state of the solvent passing the diaphragm, 3 theories are possible in certain cases of osmosis. The 1st and 2nd consider the solvent to be in the liquid or vaporous state, respectively, and the 3rd assumes that the solvent is soluble in the substance of the diaphragm. Although the experimental data at present available are insufficient for deciding whether all 3 theories are applicable to actual cases, they are compatible with the pressure-balance theory, which is considered to be indispensable for a kinetic explanation of osmotic pressure. R. N.

2284 532.712 = 3

Osmotic pressure and diaphragm effect. THIEL, A. *Kolloid Z.*, 94, *pp.* 348–349, *March*, 1941.—A reply [Abstr. 2283 (1942)] and some statements in favour of the diaphragm solution theory. R. N.

2285 532.74 : 532.13 = 3

Association and solvatation of cellulose derivatives in organic liquids. I (Osmotic measurements). II (Viscosimetric measurements). STEURER, E. *Z. phys. Chem. A*, 190, *pp.* 1–23, *Nov.*, 1941.—State of solution and intramolecular forces as found in substances having small molecules are used to explain the corresponding relations for highly polymerized substances. The state of solution of ethyl cellulose in various organic solvents is investigated by osmotic measurements. Strongly dissociating solvents, e.g. chloroform, dioxane, etc., lead to molecular solutions, less dissociating solvents, e.g. cyclohexane, benzene, etc., to the formation of supramolecules. By the addition of polar substances the balance is shifted in the direction of single molecules. The viscosity is largely dependent on the ratio between the 2 kinds of solvents. R. N.

2286 532.77 : 535.324.2 : 535.51 = 3

Dielectric investigations on acetyl cellulose in different solvents. TAKEI, M., AND ERBRING, H. *Kolloid Z.*, 94, *pp.* 312–318, *March*, 1941.—While density and refractive index are linear functions of conc. with all solvents investigated, polarization is practically independent of conc. for acetyl cellulose dissolved in ethanoic anhydride or lactic ethyl ester. If methyl-glycol-acetate, aniline or acetone are used as solvents, the polarization/conc. curve shows a slight decline. R. N.

2287 532.77 : 536.421.4 : 536.532 : 541.124.7

The determination of the activity coefficients of the methylamine hydrochlorides from freezing point data. JONES, J. H., AND SPUHLER, F. J., WITH FELSING, W. A. *J. Amer. Chem. Soc.*, 64, *pp.* 965–968, *April*, 1942.—A differential f.p. apparatus was utilized to determine the f.p. depressions of aqueous solutions of mono-, di- and tri-methylamine hydrochlorides over a conc. range 0·0025 to 1·0 molal. Conductivity data for the methylamine hydrochlorides are presented.

See Abstr. 2350 532.782 : 539.213.2 : 537.226.2

2288 533.27 = 3

Multiplication method for the separation of gas mixtures, especially by the application of gravitation fields. MARTIN, H., AND KUHN, W. *Z. phys. Chem. A*, 189, *pp.* 219–316, *Oct.*, 1941.—The possibilities are theoretically investigated of separating gas mixtures, especially isotopes, by a multiplication process based on the application of strong gravitational (centrifugal) fields. An initial single effect may be multiplied, (1) by the use of a great number of chambers, in each of which the single separator effect operates, while circulation takes place through openings in the separating walls, (2) by using an elongated chamber. In either case the circulation may be brought about by a thermal pump. A comparison is made with the separator-tube process [Abstr. 581 (1940)]. R. N.

2289 533.27 : 541.183 = 3

Temperature dependence of adsorbability as a means for continuous fractionization or concentration of solutions. KUHN, W., AND MARTIN, H. *Z. phys. Chem. A*, 189, *pp.* 317–326, *Oct.*, 1941.—Generalizing the principle previously discussed [Abstr. 2288 (1942)], the initial single effect may be produced by any other means besides gravitational fields or temperature gradients, and may be multiplied by appropriate movement. The separation of a racemic substance is described, made possible by the difference in the temperature coeff. of adsorbability of the *d* and *l* form. The experiments were made with mandelic acid contained in a chamber heated at its top plate and cooled at its bottom plate. As adsorbent an endless wool band was used, moved slowly between the 2 plates over 2 rollers. R. N.

2290 533.6.011.3 : 622.4

The free streaming of gases in sloping galleries. GEORGESON, E. H. M. *Proc. Roy. Soc. A*, 180, *pp.* 484–493, *July* 3, 1942.—A general equation is deduced for the free streaming of any gas in any sloping, rectangular, air-filled gallery. Values for the velocities and accelerations of freely streaming firedamp and hydrogen are calculated from this equation, and are compared with experimental results.

2291 533.6.691.13

A new family of wing profiles. BURINGTON, R. S., AND DOBBIE, J. M. *J. Math. Phys.*, 20, *pp.* 388–401, *Dec.*, 1941.—A new family of curves resembling wing profiles is advanced in which the generating curve is any one of a general 2-parameter family of hyperbolae. A conformal transformation which transforms a circle into any curve of the family is given. The family is more general than one suggested previously [Abstr. 4337 (1937)], which it includes as a particular case. The paper explains the use of conformal mapping in airfoil theory, and exhibits a sequence of transformations which map a circle into a closed curve resembling an airfoil section. G. E. A.

SOUND. VIBRATIONS

See Abstr. 2409 534.14 : 534.15 : 534.372 : 539.433

See Abstr. 2409 534.15 : 534.372 : 534.14 : 539.433

See Abstr. 2409 534.372 : 534.14 : 534.15 : 539.433

2292 534.41 : 621.317.76 : 621.3.018.6

An analyser for sub-audible frequencies. SCOTT, H. H. *J. Acoust. Soc. Amer.*, 13, *pp.* 360–362, *April*, 1942. [See Abstr. 1240 B (1942)].

2293 534.647

The Wiechert vertical seismograph: an improved design. WADSWORTH, J. *Mon. Not. Roy. Astr. Soc., Geophys. Suppl.*, 5, 2, *pp.* 49–53, 1942.—Modifications to the vertical seismograph at Apia Observatory are described. The period of vibration of the recording pen has been increased by increasing its moment of inertia, and the method of suspension of the pen carrier modified to reduce friction. The fundamental period of oscillation was doubled by attaching a spiral spring in such a way as to assist the motion of the pendulum. The instrument is now sensitive enough to record not only the microseisms always present at Samoa, but also the initial impulse of a distant earthquake. A. HU.

2294 534.7 : 612.85

Dynamic auditory localization. I. The binaural intensity disparity limen. FORD, A. *J. Acoust. Soc. Amer.*, 13, *pp.* 367–372, *April*, 1942.—An inquiry into the smallest binaural intensity difference that can be discriminated. Apparatus was devised which would reproduce an intensity function as the subject under test rotated his head, indicating the supposed direction of the source of sound in phones covering his ears by "pointing his nose at the sound." The sounds selected had frequencies of 200 and 2 000, and tables of results for a number of observers give the location errors in deg. for given intensity disparities in the 2 phones varying from 13·2 to 0·9 db. The average error increases as the intensity disparity diminishes, and reliable discrimination broke down at 0·9 db. It is concluded that there must be some other cue for location than pure intensity effect. G. E. A.

2295 534.7 : 612.85

A method for measuring the percentage of capacity for hearing speech. FOWLER, E. P. *J. Acoust. Soc. Amer.*, 13, *pp.* 373–382, *April*, 1942.—The method takes into account the following criteria: hearing distance, found from threshold audiograms; differences in importance of speech frequencies by properly weighting the db loss at each frequency; the "recruitment phenomenon" which always occurs in nerve deafness, and which accounts for the differences in hearing capacity in obstructive and nerve deafness; allowances for binaural as well as monaural deafness; use of the author's table of calculations of the percentage loss of capacity in which the weighted db loss of the worse ear is tabulated against the corresponding loss for the better ear. The author considers the first and last of these criteria as the most dependable. G. E. A.

2296 534.7 : 612.85

The change of phase caused by impedance deafness. LOWY, K. *J. Acoust. Soc. Amer.*, 13, *pp.* 389–392, *April*, 1942.—The route to the inner ear through the round window is of importance in certain cases. Békésy (1936) assumed that prevalence of the conducting function of the round window leads to a reversal of phase of the vibrations of the basilar membrane. Experiments indicate that interference with the sound-conductive mechanism causes a gradual change in phase of the electrical cochlear response. Injecting oil into the middle ear causes a phase shift such as would be expected from increased friction, and if the malleus is put under const. pressure a phase shift results which may be ascribed to increased stiffness. The effects are verified qualitatively by use of the differential equation of vibration and the results support Pohlman's objection to Békésy's theory. G. E. A.

2297 534.7 : 612.85

Experiments on the pellet-type of artificial drum. LOWY, K. *J. Acoust. Soc. Amer.*, 13, *pp.* 383–388, *April*, 1942.—In cases where part of the sound-conducting mechanism of the middle ear, including the drum, has been removed, a cotton pellet substitute effects considerable improvement in hearing. Electrosonic experiments on cats show that the pellet, if placed on the stapes under slight pressure, improves hearing throughout the hearing range, especially for high tones. The mechanism of the action seems to consist partly in screening the oval window and partly in increasing stiffness of the vibrating system. Bone conduction is virtually unchanged. Increased mass of the vibrating system produces of itself low-tone improvement and high-tone loss. In an appendix these results are obtained mathematically. G. E. A.

2298 534.7 : 612.85

Relation of audiogram measurements to hearing-aid characteristics based on commercial experience. KRANZ, F. W., AND RUDIGER, C. E. *J. Acoust. Soc. Amer.*, 13, *pp.* 363–366, *April*, 1942.—Discussion of a collection of audiograms obtained in the fitting of hearing-aids. The min. audibility curve as determined in the U.S. survey of 1936 is taken as standard. Air conduction (A.C.) curves are classed as having flat, rising or falling characteristics between 500 and 2 000 c./s., the relative numbers in each class being 44%, 13% and 43%, resp. These indicate greater prevalence of h.f. loss, even below 2 000 c./s. L.f. loss is, in the majority, accompanied by excellent bone conduction (B.C.). The selection of a suitable aid can be made in most cases from the audiogram curves between 1 000 and 2 000 c./s. G. E. A.

2299 534.85 : 681.85 : 621.395.625.3

Embossed-groove recording. THOMPSON, L. *Electronics*, 15, *pp.* 30–33 and 76, *March*, 1942.—[Abstr. 1272 B (1942)].

2300 534.851

Playing records with large-radius needles. *Electronic Engng*, 15, *p.* 79, *July*, 1942.—[See Abstr. 1044 (1942)].

OPTICS

2301 535.231.4 = 3

A relation between the temperature radiation of white oxides and the photo effect at sensitized metal surfaces. SKAUPY, F. *Kolloid Z.*, 94, *p.* 65, *Jan.*, 1941.—The emissive power of white oxides of different grain size has a limiting point at a certain wavelength which is the higher the finer the grain. This analogy to the selective photo-effect at metal surfaces is due to the fact that the latter is primarily based on light absorption. [See Abstr. 1539 (1941)]. R. N.

2302 535.241.41 : 518.3 : 628.9

Calculation of illumination from triangular sources. SPENCER, D. E. *J. Opt. Soc. Amer.*, 32, *pp.* 274–281,

May, 1942.—The illumination due to a uniform diffuser of triangular shape can be calculated by forming the flux-density equations, and nomographs are given to facilitate the numerical solution of these equations. Although triangular sources as such do not frequently occur in illuminating engineering, irregular shaped sources which can readily be decomposed into triangles are commonly encountered. J. W. T. W.

See Abstr. 2307 535.241.421 : 535.317.25

2303 535.243

A new apparatus for rapid photographic spectrophotometry. Davis, G. E., and Woodrow, J. W. *Rev. Sci. Instrum.*, 13, *pp.* 223–228, *May*, 1942.—A new quartz spectrograph for absorption spectrophotometry is described. The method is a modification of the usual photographic method. The instrument gives high speed, predetermined spectral distribution of absorption data, certainty of obtaining values at absorption max. and other definite wavelengths, need for fewer photographic plates, and applicability to solids as well as to solutions and other liquids.

See Abstr. 2328 535.243 : 535.733 : 535.6.08

2304 535.247.4

A new type of microphotometer. Fürth, R. *Nature, Lond.*, 149, *pp.* 730–731, *June* 27, 1942.—A short description of the principle of a new type of microphotometer, the details of which are published elsewhere.

See Abstr. 2361, 2362 535.3 : 537.531

See Abstr. 2363 535.3 : 548 : 537.531

2305 535.312

Reflection from paper. Strachan, J., Bowen, J. L., King, J. L. *Nature, Lond.*, 149, *pp.* 732–733, *June* 27, 1942.—Correspondence. [See Abstr. 2071 (1942)].

See Abstr. 2320 535.313.1 : 535.343.4.03

2306 535.316 : 518.3

A mechanical device for exhibiting the properties of a thin lens. Freeman, I. M. *Amer. J. Phys.*, 10, *pp.* 150–151, *June*, 1942.

2307 535.317.25 : 535.241.421

Resolving power as a function of intensity. Ramsay, B. P., Cleveland, E. L., and Bowen, Jr., W. A. *J. Opt. Soc. Amer.*, 32, *pp.* 288–292, *May*, 1942.—The work on resolving power as a function of intensity is extended from its original application to objective resolving power. Examination is now made of spectroscopic resolution, and the problem is attacked photographically instead of visually. Finally, the exact relationship between resolving power and intensity is examined. A. H.

See Abstr. 2327 535.323 : 535.514.2

See Abstr. 2286 535.324.2 : 535.51 : 532.77

See Abstr. 2310 535.33.03 : 535.338.332

2308 535.338.33

On the spectra of Hg II and Hg III. Mrozowski, S. *Phys. Rev.*, 61, *pp.* 605–613, *May* 1 *and* 15, 1942.—The structure of many lines of ionized mercury in the region 6 000–2 200 Å has been investigated by means of apparatus of high resolving power. Many of the lines have been found to possess complex structure. The structures are presented in the form of graphs, in which approx. distances and intensities of components are given. In a few cases more exact values of the distances are indicated. The most interesting are lines with isotope shifts which are the highest among all known spectra, and most of which at the same time possess no observable hyperfine structure. Since a discussion shows that probably they do not belong to Hg III, their presence furnishes evidence for the existence of 2 previously unknown sets of levels in Hg II.

2309 535.338.332

The hyperfine structure of Cs II. Boyd, R. A., and Sawyer, R. A. *Phys. Rev.*, 61, *pp.* 601–605, *May* 1 *and* 15, 1942.—The first spark spectrum of Cs II was photographed in the visible region with equipment including an electrodeless discharge, a Fabry–Perot interferometer, and a glass Littrow-type spectrograph. The hyperfine structure of 13 lines was measured and 12 of the patterns were analysed and identified. The work was undertaken with a view to distinguishing the *s* levels from the *d* levels, to establishing more definitely the *J* values of known energy levels, and to locating undiscovered energy levels.

2310 535.338.332 : 535.33.03

The first spark spectrum of caesium (Cs II). Wheatley, M. A., and Sawyer, R. A. *Phys. Rev.*, 61, *pp.* 591–600, *May* 1 *and* 15, 1942.—With an electrodeless discharge in a quartz tube the first spark spectrum of Cs II has been rephotographed in the region $\lambda 2\,954{\cdot}07$–$\lambda 1\,857{\cdot}45$ by means of 3 sizes of quartz spectrographs. In all, 37 levels were established and 189 lines classified. It was also possible, through the discovery of *f* terms, to separate the *d* terms from the *s* terms of the $5p^5(^2P_{\frac{1}{2}})6d$, $7s$ configuration because of the failure of the *f* and *s* terms to combine. The classifications, assignment of inner quantum numbers, and the identification of levels, agree with the theoretical considerations as well as with the predictions from the Xe I classification.

2311 535.338.4 : 523.162

Band spectrum and structure of the CH^+ molecule; identification of three interstellar lines. Douglas, A. E., and Herzberg, G. *Canad. J. Res. A*, 20, *pp.* 71–82, *June*, 1942.—In a discharge through He, to which a small trace of benzene vapour is added, a new band system of the type $^1\Pi - {}^1\Sigma$ is found which is shown to be due to the CH^+ molecule. The $R(0)$ lines of the 0–0, 1–0 and 2–0 bands of the new system agree exactly with the hitherto unidentified interstellar lines 4 232·58, 3 957·72, 3 745·33 Å, thus proving that CH^+ is present in interstellar space. This observation of the band system in absorption shows that the lower state $^1\Sigma$ is the ground state of the CH^+ molecule. The new bands are closely analogous to the $^1\Pi - {}^1\Sigma^+$ BH bands.

2312 535.338.41

The infra-red spectra of ammonium halides. Williams, D. *J. Amer. Chem. Soc.*, 64, *pp.* 857–860, *April*, 1942.—The infra-red transmission of aqueous solutions of the ammonium halides has been measured and compared with the transmission of the powdered salts. The results obtained in the 7 μ region are in agreement with Reinkober's results [Abstr. 732

(1926)]. The 7 μ and 5·8 μ bands are shifted to shorter wavelengths in the solid-to-solution transition except in the case of fluoride, but no definite conclusions can be reached concerning variation in the ammonium bands near 3·2 μ because of hydrolysis effects. Evidence for changes in the associational structure of the solvent is found in the 4·7 μ region.

2313 535.338.42

Determination of the vibrator strengths in the atomic spectra. ROGESTWENSKY, D. S., AND PENKIN, N. P. *J. Phys., U.S.S.R.*, 5, 5–6, *pp.* 319–337, 1941.—The adaptability of the "hook" method in the determination of the intensities of lines in the spectra of refractory elements has been investigated. Observations were carried out with a specially designed interferometer. A column of vapours of the element was obtained in a King's furnace and the temperature brought up to 3 000°C. The intensities of 16 lines in the spectrum of Fe were determined visually. A close triplet $^5S_2$–$^5P_{1,2,3}$ in the Cr spectrum was photographed. A calculation method is elaborated to account for the influence of any number of very close neighbouring lines. Measurements were taken of the anomalous dispersion in the subordinate series of K and Na and of some lines of normal and ionized Ba.

2314 535.338.42 : 535.375.5

On the intensities in vibration spectra of polyatomic molecules. WOLKENSTEIN, M. W. *J. Phys., U.S.S.R.*, 5, 2–3, *pp.* 185–203, 1941.—On the basis of the vector and tensor additivity scheme, employed in the theory of the structure of molecules (electrical and optical), a semi-empirical method has been worked out for calculating the intensities in infra-red and Raman vibration spectra of polyatomic molecules. The method was verified on several halogen derivatives of methane. It is possible to employ the relative measurements for determining such characteristics of the valence bonds as the derivatives of the polarizability and the dipole moment with respect to the distance. The connection between the intensity and the form of the vibration is established.

2315 535.341 : 535.379 = 3

Light absorption of gelatin dyestuff phosphors and Beer's law. MISCHUNG, H. *Kolloid Z.*, 94, *pp.* 153–157, *Feb.*, 1941.—Solid gelatin dyestuff phosphors with Rhodulin orange N used as a dyestuff were investigated. Measurements were made for dyestuff conc. of 10^{-2} to $10^{-3\cdot5}$ g./cm.^{3} gelatin in the visible and ultra-violet ranges. For conc. below $10^{-2\cdot5}$ the extinction increases arithmetically with a geometrical decrease of conc., while for conc. above $10^{-2\cdot5}$ Beer's law is applicable. It is assumed that the deviations from Beer's law are caused by the excitation of luminescence. R. N.

2316 535.343 = 3

Absorption spectra of pyrrol dyestuffs. III. PRUCKNER, F., AND DOBENECK, H. VON. *Z. phys. Chem. A*, 190, *pp.* 43–55, *Nov.*, 1941.—Continuing previous work [see Abstr. 3714 (1938)] the authors show that the dioxypyrromethenes form an intermediate step between methanes and methenes. The absorption spectrum resembles that of the methanes. Extinction coeff. and position of the max. of the bands are tabulated for various pyrrol dyestuffs. R. N.

2317 535.343.3

Formation of conjugated material during bleaching of vegetable oils. MITCHELL, JR., J. H., AND KRAYBILL, H. R. *J. Amer. Chem. Soc.*, 64, *pp.* 988–994, *April*, 1942.—Alkali refining of vegetable oils as well as refining by adsorption with a special silicate adsorbent results in a decrease of absorption in the ultra-violet region. This is thought to be due to removal of some of the non-fat constituents. Bleaching with fuller's earth causes the development of definite absorption bands. Oils containing only linoleic acid develop bands at 2 680 Å while oils containing both linoleic and linolenic acids develop bands at 2 680, 3 000 and 3 160 Å. By low-temperature crystallization from solvents, the most unsaturated fraction of bleached linseed oil fatty acids was obtained. This process removed the substance causing a band at 2 680 Å, leaving the highly unsaturated fraction with a spectrum similar in character to that obtained for the 4 double-bond conjugated system in decatetraene and in parinaric acid.

2318 535.343.31

The determination of the concentration of benzene and toluene in air by a spectroscopic method. COLE, P. A. *J. Opt. Soc. Amer.*, 32, *pp.* 304–306, *May*, 1942.

2319 535.343.31

Absorption spectra of 3–4 benzpyrene. WEIGERT, F. *Nature, Lond.*, 150, *p.* 56, *July* 11, 1942.—The absorption spectra were studied with a l.v. projection lamp as a light source for a continuous spectrum.

2320 535.343.4.03 : 535.313.1

Long optical paths of large aperture. WHITE, J. U. *J. Opt. Soc. Amer.*, 32, *pp.* 285–288, *May*, 1942.—Examination of vapour-phase spectra of compounds with high boiling points can be effected either by heating the absorption cell or increasing the length of cell. When only a small amount of the substance is available, an optical system in which the radiation goes back and forth several times must be used. A system is described, involving the use of three spherical mirrors, which allows the light to traverse a small volume a large and arbitrarily variable number of times, and which permits of the use of large angular apertures at points off the optic axis. The advantages are given in detail. A. H.

2321 535.37

Luminescent coatings. *Rep. Off. Dig. Fed. Paint Varn. Prod. Cl., Project No.* 6, [10 *pp.*], *Feb.*, 1942.—The Sub-Committee report describes luminescent paints and coatings from the standpoint of their known properties and uses at the present time, and indicates their practical value and limitations.

See Abstr. 2314 535.375.5 : 535.338.42

2322 535.375.5 : 541.123.2

Raman effect in partially miscible liquid systems. SREE. *J. Mysore Univ.*, 2, 15, *pp.* 105–107, 1942.—Two partially miscible liquids, when shaken together and allowed to settle down, will separate into 2 phases with a sharp surface of separation. If the Raman spectra of the 2 phases are studied simultaneously, it becomes possible to obtain the extent of the solubility of one liquid in the other, besides any significant features at the interface.

2323 535.375.51

Raman line of cyanide ion. GLOCKLER, G., AND BAKER, H. T. *J. Chem. Phys.*, 10, *pp.* 305–306, *May*, 1942.

2324 535.379 = 3

Negatively polarized emission of gelatin dyestuff phosphors. FRÖHLICH, P., AND GOMBAY, L. *Kolloid Z.*, 94, *pp.* 147–152, *Feb.*, 1941.—Various dyestuffs dissolved in gelatin were investigated. If cooled to − 180°C., their phosphorescence emission is negatively polarized. If slowly heated, the degree of polarization increases, passes through zero and reaches a selective max. beyond which it decreases to a const. value. The temperature at which the degree of polarization passes through zero is independent of conc. but different for different phosphors. The abs. value of the degree of polarization decreases with increasing conc. The phosphor must be cooled first to a low (critical) temperature; if cooled slowly from room temperature the degree of polarization will only decrease to zero. Neither negative polarization nor selective max. appear if the phosphor has been heated to 100°C. before the test. The results are in agreement with the theories of Perrin [Abstr. 2149 (1930)] and Jablónski [Abstr. 4221 (1935)]. R. N.

See Abstr. 2315 535.379 : 535.341

2325 535.392

Colours of furniture. MOON, P. *J. Opt. Soc. Amer.*, 32, *pp.* 293–298, *May*, 1942.—In continuation of previous work on the reflection characteristics of interior decoration in rooms [Abstr. 1564, 2087 (1941), 1067, 2070 (1942)], the author lists the reflection factors and trichromatic coefficients for about 80 samples of interior furnishings, viz. desk tops, enamelled steel furniture and upholstery materials. J. W. T. W.

See Abstr. 2364, 2474, 2475 535.4 : 537.531 : 548

See Abstr. 2471 535.4 : 548

See Abstr. 2273 535.417 : 531.787.2

2326 535.43.07

A turbidity comparator. KREBS, R. P., PERKINS, P., TYTELL, A. A., AND KERSTEN, H. *Rev. Sci. Instrum.*, 13, *pp.* 229–232, *May*, 1942.—An a.c. operated photoelectric turbidity comparator which has been found useful in assaying physiologically active substances by measuring the growth of micro-organisms is described. A special feature is that the power supply for both the amplifier and the light source is electronically stabilized.

See Abstr. 2286 535.51 : 535.324.2 : 532.77

2327 535.514.2 : 535.323

The optical dispersion of copper and beryllium. GIVENS, M. P. *Phys. Rev.*, 61, *pp.* 626–630, *May* 1 *and* 15, 1942.—The optical constants of Cu and Be have been measured over a wavelength range from 2 200 Å to 9 800 Å. The observations were made by examining the state of polarization of light after reflection from a plane surface of the metal, the incident light having been linearly polarized. The surfaces were formed on a glass backing by evaporation. The absorption band of Cu usually found in the neighbourhood of 5 000 Å was not observed. Positive values of the dielectric const. were found. In the Be spectrum a strong absorption band was observed near 3 000 Å.

2328 535.6.08 : 535.733 : 535.243

Research on colour physics at South Kensington, 1877–1942. WRIGHT, W. D. *Proc. Phys. Soc., Lond.*, 54, *pp.* 303–313, *July*, 1942.—The colour research carried out by Abney is briefly reviewed and compared with that carried out more recently in the Imperial College. The instrumental methods employed by Abney and the writer are examined in relation to current problems in the design of colorimeters and spectrophotometers, including mechanical construction, viewing of the matching field, intensity control and precision of the optical parts. The spectral-mixture curves are discussed in connection with the variation of colour matching amongst different observers and with the possibility of correcting these variations. The work on colour discrimination is reviewed, and its bearing on the specification of colour tolerances and the derivation of a uniform-chromaticity scale discussed.

2329 535.733

Visual sensitivities to colour differences in daylight. MACADAM, D. L. *J. Opt. Soc. Amer.*, 32, *pp.* 247–274, *May*, 1942.—The sensitivity of the eye to colour difference at all parts of the colour triangle has been determined under const. conditions, viz. vertically divided 2° field of 15 millilamberts brightness surrounded by 42° field of half that brightness and colour that of standard illuminant C. The field is viewed through a 2·6 mm. artificial pupil. The observations were made by a single observer and the std. deviations in making a colour match are represented on the I.C.I. colour diagram by a series of ellipses, one for each of the 100 or so colours used. These ellipses cannot be transformed into equal-sized circles by any projective transformation of the diagram. J. W. T. W.

See Abstr. 2328 535.733 : 535.243 : 535.6.08

2330 535.88

Optical projection as an aid in studying plane spiral coiling of small fossil lamellibranchs. DOLLAR, A. T. J. *Nature, Lond.*, 150, *pp.* 57–58, *July* 11, 1942.

HEAT. THERMODYNAMICS

2331 536.2.02

On a paradox in the theory of heat conduction. JAFFÉ, G. *Phys. Rev.*, 61, *pp.* 643–647; *May* 1 *and* 15, 1942.—The classical theory of heat conduction leads to infinite values for the heat current and for the propagation of temperature at $t = 0$, if the initial conditions involve a discontinuity in the temperature distribution. These paradoxical results can be avoided if a method is applied which has been previously indicated [Abstr. 555 (1931)]. The solution of a fundamental problem in gaseous heat conduction is given to a first approximation. The solution is compared with the classical one, and it is shown that all results of the latter which are devoid of physical sense disappear.

2332 536.212.2 : 621.386.032.22

Transient temperatures in the anode of an X-ray tube. ABBOTT, F. R. *J. Appl. Phys.*, 13, *pp.* 384–

389. *June*, 1942.—The rapid heating and cooling cycle of the focal area of a high-speed radiographic X-ray tube anode results in short life, although max. temperatures produced are not excessive. An operational solution is obtained in terms of Bessel functions. From the calculated temperature distribution the mechanism of disruption is explainable.

2333 536.242 : 621.385.032.42

Water and forced-air cooling of vacuum tubes. MOUROMTSEFF, I. E. *Proc. Inst. Radio Engrs, N.Y.*, 30, *pp.* 190–205, *April*, 1942.—[Abstr. 1258 B (1942)].

2334 536.244 : 621.3.012.8

A method of determining unsteady-state heat transfer by means of an electrical analogy. PASCHKIS, V., AND BAKER, H. D. *Trans. Amer. Soc. Mech. Engrs*, 64, *pp.* 105–110; *Disc.*, 110–112, *Feb.*, 1942.—[Abst. 1154 B (1942)].

2335 536.244 : 666

High-temperature recuperators WAGSTAFF, J. B. *J. Soc. Glass Technol.*, 26, *pp.* 5–21 (*T*), *Feb.*, 1942.—The paper discusses the general design of recuperators for use in the glass industry, attention being given to the effect of radiation from the non-luminous gases and from the brick walls The size of a recuperator may be calculated by considering the heat flow from the waste gases to the tubes and from the tubes to the air separately. It is advantageous to include suitably placed baffles to remove heat from the waste gas and to re-radiate it to the tubes. This re-radiation can amount to as much as 40% of the total heat transfer. The use of existing data gives an overall accuracy of about 10% in the calculated values. R. W. P.

2336 536.33 : 66.041

Some fundamental aspects of heat transmission by radiation from flames and furnace linings. SMITH, E. C. W., ROBERTS, A. L., AND TOWNEND, D. T. A. *J. Soc. Glass Technol.*, 26, *pp.* 113–129 (*T*), *April*, 1942.—The importance of heat transfer by radiation from (*a*) flames and hot products of combustion and (*b*) heated furnace walls, is discussed. With non-luminous aerated flames, the principal emitters are water and CO_2 molecules which emit selectively, a time factor in the case of CO_2 being of some importance. The emission from luminous flames depends upon the presence of carbon aggregates of varying magnitude and approximates to black-body radiation; if hydrocarbon-containing fuels are obtainable, considerable advantage may be taken of working with luminous flames. Refractory materials are intrinsically selective radiators, but under service conditions their characteristics are so modified that they approach those of a black body.

2337 536.413 : 548.55

Thermal expansion of single and optically mosaic zinc crystals. STAKER, W. P. *Phys. Rev.*, 61, *pp.* 653–657, *May* 1 *and* 15, 1942.—Thermal expansions of 16 Zn single crystals have been measured in the temperature range 25° to 100°C. by an optical lever method. The dependence on orientation followed the expected cosine-squared symmetry relation. Slight differences in purity did not affect the values of the expansion coefficients, nor did optically mosaic crystals differ from true singles. Permanent strain lowered the coefficients slightly.

2338 536.421.1

Note on the theory of fusion. KIRKWOOD, J. G., AND BOGGS, E. M. *J. Chem. Phys.*, 10, *p.* 307, *May*, 1942.—[See Abstr. 2117 (1941)].

See Abstr. 2287 536.421.4 : 536.532 : 541.124.7 : 532.77

2339 536.423.15

Vapour pressures of aqueous solutions at high temperatures. KEEVIL, N. B. *J. Amer. Chem. Soc.*, 64, *pp.* 841–850, *April*, 1942.—Data within the temperature range 150°–650° are reported. Critical conditions near the critical point for water are confirmed for Na_2CO_3 and for Na_2SO_4. Continuous curves are obtained for saturated solutions of highly soluble salts, showing max. v.p. at temperatures intermediate between the triple points of water and of salt, and no critical region. The max. v.p. appears to be less, the greater the initial temperature coeff. of solubility, and the lower the m.p. of the salt.

See Abstr. 2360 536.48 : 537.525.8

2340 536.483

An apparatus for obtaining temperatures below 0·8°K. LASAREW, B. G., AND ESSELSON, B. N. *J. Phys., U.S.S.R.*, 5, 2–3, *pp.* 151–154, 1941.—On the basis of the known properties of He II an apparatus was constructed for obtaining temperatures below 0·8°K. by pumping off the vapours above liquid He with a low-speed pumping system. The temperature obtained, as estimated by the magnitude of the magnetic field which destroys the superconductivity of Zn, is 0·73°K.

See Abstr. 2287 536.532 : 541.124.7 : 536.421.4 : 532.77

2341 536.6

The heat of fusion and the heat capacities of solid and liquid white phosphorus. YOUNG, F. E., AND HILDEBRAND, J. H. *J. Amer. Chem. Soc.*, 64, *pp.* 839–840, *April*, 1942.—The molal heat capacity of solid white phosphorus, P_4, in the range 0–44·2° is

$$C_p = 21{\cdot}46 + 2{\cdot}872 \times 10^{-2}t$$

That of liquid phosphorus in the range 25°–97° is

$$C_p = 24{\cdot}47 - 9{\cdot}521 \times 10^{-3}t - 3{\cdot}927 \times 10^{-5}t^2$$

The heat of fusion is 601 cal./mole at the m.p., 44·2°.

2342 536.62

Measurement of latent heat by the gas-current method. GOFF, J. A., AND HUNTER, J. B. *J. Appl. Mech.*, 9, *A*21–*A*25, *March*, 1942.—In the gas-current method for the determination of lat. ht. of vaporization the liquid under test is contained in an adiabatic calorimeter and a steady stream of dry non-reactant gas at the liquid temperature is bubbled through. The amount of electrical energy required to heat the gas to its original temperature is measured and the water removed from the gas and weighed. Apparatus for making this determination is described, and a thermodynamic analysis of the method is given, and applied to data for the evaporation of water into air. When allowance is made for the effect of intermolecular forces in the vapour phase a knowledge of the inter-action const. is required. R. W. P.

2343 536.631

The theory of the specific heat of solids. BLACKMAN, M. *Rep. Phys. Soc. Progr. Phys.*, 8, *pp.* 11–29, 1942.—A general account of recent developments in the theory of the specific heats of solids. The method adopted originally by Born and v. Kármán has been vindicated by the use of the vibration spectrum which differs from that assumed by Debye. The properties of the vibration spectrum explain deviations from the predictions of the Debye theory at low temperatures. R. W. P.

See Abstr. 2472, 2473 536.631 : 548

See Abstr. 2467 536.653 : 536.75 : 541.8

2344 536.654

On the heat of sublimation of carbon. HERZBERG, G. *J. Chem. Phys.*, 10, *pp.* 306–307, *May*, 1942.—[See Abstr. 2660 (1941)]. A criticism.

2345 536.657

Calorimetric investigations of organic reactions. IV. The heats of ionization of *dl*-alanine at 25°. STURTEVANT, J. M. *J. Amer. Chem. Soc.*, 64, *pp.* 762–768, *April*, 1942.—[See Abstr. 621 (1941)]. Calorimetric measurements of the heats of neutralization of *dl*-alanine by HCl and NeOH at 25° are reported. A double extrapolation of the results is employed to give values of the acidic and basic ionization heats.

2346 536.66 = 3

On synthetic substances I/1. Reaction heats of acid and alkaline mixtures of phenol and formaldehyde. MANEGOLD, E., AND PETZOLDT, W. *Kolloid Z.*, 94, *pp.* 284–294, *March*, 1941.—The temperature rise caused by the reaction started at 90°C. between phenol and formaldehyde in acid or alkaline medium, respectively, was measured in a high-temperature calorimeter which is described in detail. In the acid medium, rapidly progressing exothermic reactions were found, characterized by well-defined temperature jumps preceded and followed by linear temperature/time curves. In the alkaline medium the reactions proceed slowly and the final point could not be established by calorimetric means. The measured temperature jumps are used for calculating the molecular heat of reaction for different molecular ratios. R. N.

See Abstr. 2416 536.66 : 539.153 : 541.57 : 541.11

See Abstr. 2467 536.75 : 536.653 : 541.8

2347 536.791.2 : 530.12

Thermodynamics of a relativistic Fermi–Dirac gas. KOTHARI, D. S., AND SINGH, B. N. *Proc. Roy. Soc. A*, 180, *pp.* 414–423, *July* 3, 1942.—The thermodynamic properties—energy, pressure, free energies and entropy—for a Fermi–Dirac ide l gas are derived, taking account of the effect of relativistic mechanics. The results are expressed in convenient series-expansions. The degenerate and non-degenerate cases are considered.

ELECTRICITY. MAGNETISM

2348 537.221

Contact potentials. I. General principles. II. Volta effect. CHALMERS, J. A. *Phil. Mag.*, 33, *pp.* 399–430, *June*, 1942.—I. Definitions and general principles are laid down. There are 2 distinct ways of defining interphase potential differences, both leading to the same result, that the sum of the interphase potential differences is equal to the measured potential difference of the complete system. II. The Volta effect is discussed in connection with the contact theory and the chemical theory. It is shown that both theories give adequate explanations, but the ideas of each must not be mixed. Replacement of a vacuum by a dielectric does not alter the Volta effect. The relationship of the Volta effect with the Peltier effect and the photo-electric work function is discussed. A. J. M.

2349 537.222.2 : 621.3.015.1 = 3

Space charge and voltage distribution in insulating materials. BÖNING, P. *Kolloid Z.*, 94, *pp.* 31–39, *Jan.*, 1941.—[Abstr. 1158 B (1942)].

See Abstr. 2381 537.226.2 : 531.756 : 539.133

2350 537.226.2 : 532.782 : 539.213.2

The dielectric behaviour, supercooling and vitrification of certain chlorobutanes and chloropentanes. TURKEVICH, A., AND SMYTH, C. P. *J. Amer. Chem. Soc.*, 64, *pp.* 737–745, *April*, 1942.—The dielectric const. and sp. conductances have been measured over a wide range of temperature at frequencies of 0·5, 5 and 50 kc./s. The substances have also been observed over a wide range of temperature with a polarizing microscope. The molecules of the four substances are too unsymmetrical to rotate in the crystalline state. The tendencies to crystallize or vitrify are compared with those of other alkyl halides and hydrocarbons. Some irregularity of molecular form and the possible coexistence of 2 or more molecular shapes contribute toward a tendency to vitrification. A small difference in the size of an atom or group in a molecule may make a large difference in the tendency to vitrify.

See Abstr. 2380 537.226.2 : 539.133

2351 537.312.8

Dependence of the electrical resistance of gold and several of its alloys on a magnetic field at low temperatures. NAKHIMOVICH, N. M. *J. Phys., U.S.S.R.*, 5, 2–3, *pp.* 141–150, 1941.—Measurements of the dependence of the resistance on a transverse and longitudinal magnetic field up to 16 kG at liquid He temperatures were carried out for samples of Au, Au + Ag and Au + Fe (for the latter also at 20·4°K.). Slight admixtures of Fe cause a decrease in the resistance of Au in a transverse and longitudinal magnetic field at a sufficiently low temperature. For an Fe conc. of 0·01% a decrease in the resistance in a magnetic field sets in at liquid-He temperatures. A decrease also occurs as a result of contamination of Au by Fe and its deformation in drawing the wire. These results point to the cause of the anomalous sign of the change in resistance in a magnetic field for the alloy investigated by Giauque and co-workers. A connection is assumed between the observed properties of Au + Fe alloys and the properties of ferromagnetic metals above the Curie temperature.

2352 537.324 : 621.362 : 621.317.332

Input impedances of vacuum thermojunctions at ultra-high frequencies. ROGERS, D., AND WILLIAMS, G. *Nature, Lond.*, 149, *pp.* 668–669, *June* 13, 1942.—[Abstr. 1226 B (1942)].

2353 537.362

Electrokinetic behaviour of carborundum. HAM, A. J., AND HODGSON, W. *Trans. Faraday Soc.*, 38,

pp. 217–221, *June–July*, 1942.—An apparatus for making electro-osmotic measurements is described, and a technique whereby surface conductivity errors are eliminated. Reproducible results for carborundum have been obtained, agreeing with earlier results as regards iso-electric point and mobility under identical conditions. Carborundum behaves electrokinetically as an insulator. Over the limited voltage range used, mobility and applied voltage are linearly related.

2354 537.363 = 3

Electrodialysis and electrophoresis in starch research. SAMEC, M. *Kolloid Z.*, 94, *pp.* 350–358, *March*, 1941.—A progress review covering the last 30 years, with an illustrated description of the apparatus used for electrodialysis of starches. R. N.

2355 537.525 : 537.542.3 : 621.3.032.24

Excitation of the anode effect. COPELAND, P. L., AND CARNE, G. G. *Phys. Rev.*, 61, *pp.* 635–642, *May* 1 *and* 15, 1942.—The effects observed are ascribed to a surface consisting of Th on O on Ni. For the purpose of making the analysis quantitative, an order of magnitude for the thickness of the film has been assumed and an arbitrary definition of electron capture has been introduced. Computations on this basis indicate that the probability of electron capture is surprisingly high. The likelihood of trapping an electron incident on the surface is relatively large when it has an energy corresponding to a few volts, and this likelihood falls at first slowly and then more rapidly as the energy of the incident electron is increased. The probability of electron capture falls rapidly as the temperature of the surface is raised. When an equilibrium state is disturbed either by increasing or decreasing the current to the surface, the rate of contact potential shift is at first relatively rapid and it decreases very much as a new equilibrium is approached.

2356 537.525 : 539.231 : 621.385

Cathodic sputtering. HAIGH, C. P. *Electronic Engng*, 15, *pp.* 61–64, 1942.—[Abstr. 1257 B (1942)].

2357 537.525.5 : 621.316.5.064.4 : 621.314.653 = 3

Electrostatic extinction of the arc by the starving (de-ion) principle. WEHNER, G., MEINHARDT, H. *Arch. Elektrotechn.*, 35, *pp.* 692–694, *Dec.* 15, 1941.—[Abstr. 1193 B (1942)].

2358 537.525.6

Characteristics of the positive column of gaseous discharge. KLARFELD, B. *J. Phys., U.S.S.R.*, 5, 2–3, *pp.* 155–175, 1941.—Computation of the principal characteristics of the l.p. positive column was carried out and compared with available exp. data. The computed and exp. characteristics of the column are found to agree both in the form and abs. magnitude. The effect of various factors giving rise to a discrepancy between computed and exp. data, with increasing pressure, is discussed. These factors are the collisions of positive ions and atoms of gas, cumulative ionization, rarefaction along the column axis, etc.

2359 537.525.8

Nature of reactions occurring in the production of the afterglow of active nitrogen and the effect of temperature on the phenomena. DEBEAU, D. E. *Phys. Rev.*, 61, *pp.* 668–669, *May* 1 *and* 15, 1942.—The first step in the recombination of atomic N is the formation of a collision complex, which is then destroyed by one of 4 mechanisms, the afterglow being produced by one of them. The changes of intensity of the afterglow with temperature can be explained by the effect of temperature on the rates of the various possible mechanisms. A. J. M.

2360 537.525.8 : 536.48

The decomposition of methane in glow discharge at liquid-air temperature. YEDDANAPALLI, L. M. *J. Chem. Phys.*, 10, *pp.* 249–260, *May*, 1942.—The decomposition of methane in the glow discharge at liquid-air temperature has been investigated under different experimental conditions. The reaction products are hydrogen, a polymer of composition $(CH_2)_n$, and ethane, ethylene and acetylene. In the negative glow, the rate of methane decomposition is $\propto$ the current, and the electronic efficiency is ~ 10, both for a.c. and d.c. In the positive column, the rate is $\propto$ current only if pressure and field strength are const.; the electronic efficiency is $\sim 0{\cdot}2$ for a.c. and $\sim 0{\cdot}6$ for d.c. No marked difference in reaction rate or products is observed by substituting Fe for Al electrodes, or by variation in current density. A certain chemical activity might be attributed to the Faraday dark space.

2361 537.531 : 535.3

Theory of the continuous X-ray spectrum. WEINSTOCK, R. *Phys. Rev.*, 61, *pp.* 584–590, *May* 1 *and* 15, 1942.—The theory of continuous X-radiation from thin targets—relativity and retardation of potential neglected—is completed by the incoherent integration of the single-process transition probabilities over the unit sphere. This is carried out by series expansion. Comparison with the abs. intensity determination of Smick–Kirkpatrick gives a result too large by a factor greater than 2·5. The theory compares satisfactorily with the abs. measurement of Clark–Kelly and the rel. measurements of Harworth–Kirkpatrick.

2362 537.531 : 535.3

Effect of thermal vibrations on the scattering of X-rays. III. BORN, M. *Proc. Roy. Soc. A*, 180, *pp.* 397–413, *July* 3, 1942.—[See Abstr. 2110 (1941)]. Contains a comparison of Raman's explanation of the diffuse scattering with the so-called "thermal" theory. Raman's demand of a theory based on quantum principles is satisfied by the modern forms of the thermal theory. The relation of the dynamical matrix (describing the mechanical properties of the lattice) and the scattering matrix (describing the scattering power) is discussed. The influence of the ordinary Raman effect (mutual deformation of atoms) on the scattering is derived.

2363 537.531 : 535.3 : 548

Diffuse scattering of X-rays by crystals. II. Detailed calculation of the surfaces of isodiffusion for the (002), (112), (222) and (110) reflections of sodium single crystals. JAHN, H. A. *Proc. Roy. Soc. A*, 180, *pp.* 476–483, *July* 3, 1942.—The results obtained in previous publications [Abstr. 1091 (1942)] have been completed by a detailed calculation of the surfaces of isodiffusion for the (002), (112), (222) and (110) reflections of Na single crystals. The surfaces are plotted in stereographic projection, and these theoretical predictions are in agreement with experiment.

The Faxén–Waller theory of the diffuse scattering process has thus received decisive experimental confirmation.

2364 537.531 : 535.4 : 548

The effect of thermal vibrations on the scattering of X-rays. II. SARGINSON, K. *Proc. Roy. Soc. A*, 180, 982, *pp.* 305–320, *June* 5, 1942.—[Abstr. 2110 (1941)]. The theory of background scattering is worked out in detail. It is shown that only the acoustical branches of the elastic spectrum can produce extra spots. The temperature dependence of the background intensity is discussed. It is shown that the properties of an extra spot in the vicinity of a Laue spot can be derived from the elastic constants of the crystal, and explicit formulae for the position and shape of the spots are given for cubic crystals with diagonal lattices.

See Abstr. 2474, 2475 537.531 : 535.4 : 548

2365 537.533.7 : 548.55

Field emission from tungsten and thoriated tungsten single crystals. DANIEL, J. H. *Phys. Rev.*, 61, *pp.* 657–667, *May* 1 *and* 15, 1942.—Electron projector images of field emission from W single crystals at temperatures above 1 100°K. show a reproducible time sequence of different pattern types. These changes are due to changes of position of atoms of impurities adsorbed on the surface, and their presence is a good test for a clean W surface. The relative variation of emission intensity with crystallographic direction observed in thermionic emission is found again in field emission, though in the latter case the magnitudes of the variations are greater. Distinctly different types of field emission patterns were obtained from thoriated points on W than from W upon which Th was evaporated externally, though these differences disappeared on outgassing. A. J. M.

2366 537.533.72 : 539.166.2

Internal conversion of γ-rays from RaC. CONSTANTINOV, A. A., AND LATYSHEV, G. D. *J. Phys., U.S.S.R.*, 5, 4, *pp* 239–247, 1941.—The natural β-spectrum of RaC is investigated with a magnetic spectrograph employing the Danysz magnetic focusing method, the β-electrons being recorded by coincidence discharges in Geiger–Müller counters. Magnitudes of $p\alpha$ are determined for intense γ-lines of RaC. The theory of internal conversion is verified. The ratios of the probabilities of internal conversion in the K- and L-shells for various γ-lines are determined. Multipolarity of hard γ-lines of RaC is also determined.

2367 537.533.73 = 3

On the space-charge effect in a beam of charged particles with rectangular section of the screen. HOUTERMANS, F. G., AND RIEWE, K. H. *Arch. Elektrotechn.*, 35, *pp.* 686–691, *Dec.* 15, 1941.—[See Abstr. 1854 B (1938)]. For calculating the dispersion with beams of rectangular section it is assumed that the length of the beam is $>>$ the dimensions of the screen opening. If the latter is a narrow slit of considerable height, no broadening of the beam occurs in the vertical direction and the transversal broadening may be treated as a plane problem. For arbitrary angles of aperture the beam is parabolic in outline. Const. current density is assumed in the screen opening. The results of the calculation for the narrow slit agree with those of other authors [Abstr. 1942 B (1940)]. R. N.

See Abstr. 2399 537.533.73 : 539.234

2368 537.533.74

Secondary scattering of electrons in silicon. JOHNSON, R. P., AND GRAMS, W. R. *Phys. Rev.*, 61, *pp.* 671–672, *May* 1 *and* 15, 1942.

2369 537.533.74

The nuclear scattering of electrons in thin metallic films. II. PETUKHOV, V. A., AND VYSHINSKY, I. A. *J. Phys., U.S.S.R.*, 5, 2–3, *pp.* 137–139, 1941.—[See Abstr. 145 (1942)]. The scattering of electrons in gold foil $2{\cdot}7 \cdot 10^{-7}$ cm. thick in an angle interval from 119·5° to 122° and within an energy range from 40 to 150 eKV is investigated. Experimental results obtained pointed to the possible influence of the double scattering of electrons along the foil. The rough calculation gives the correct order of magnitude of the observed effect.

2370 537.533.74

The scattering of fast electrons. I. KULCHITSKY, L. A., AND LATYSHEV, G. D. *J. Phys., U.S.S.R.*, 5, 4, *pp.* 249–261, 1941.—Method and apparatus are described. The multiple scattering of fast electrons of 2·25 eMV energy is investigated in Al, Fe, Cu, Mo, Ag, Sn, Ta, Au and Pb foils. The exp. results are compared with theory. For the elements from Al to Sn the multiple scattering coincides with the theoretical. For the heavy elements Ta, Au, Pb, the observed scattering is less than the theoretical by 10–13%.

2371 537.534 : 539.185

Stars and slow protons at 14 125 feet. POWELL, W. M. *Phys. Rev.*, 61, *pp.* 670–671, *May* 1 *and* 15, 1942.—The appearance of a large number of heavily ionizing particles in a Wilson cloud chamber containing 5 horizontal Pb plates 1 cm. thick is due to the action of energetic neutrons on material outside the chamber. A. J. M.

See Abstr. 2355 537.542.3 : 537.525 : 621.3.032.24

2372 537.591.5

Cloud-chamber photographs at 4 310 m. altitude. BOSTICK, W. H. *Phys. Rev.*, 61, *pp.* 557–564, *May* 1 *and* 15, 1942.—Cloud-chamber photographs taken at 4 310 m. altitude give evidence for the existence of penetrating particles in air showers. Out of 2 983 successful expansions, 5·8% showed particles classified either as slow mesotrons or slow protons. 1·3% of the expansions show particles whose sp. ionization increases markedly on passing through a 1·3 cm. Pb plate in the chamber. 27 photographs show penetrating pairs and thus indicate the production of penetrating secondaries at this altitude. Some photographs give evidence for nuclear processes associated with showers. 5 photographs show electrons which may have come from the disintegration of mesotrons within the chamber.

2373 537.591.8

Multiple secondary effects of the penetrating cosmic radiation at sea level. AUGER, P., AND DAUDIN, J. *Phys. Rev.*, 61, *pp.* 549–556, *May* 1 *and* 15, 1942.—The production of multiple secondary particles by cosmic rays under thick layers of Pb has been studied with

coincidence counters and with a cloud chamber. Part of the coincidences obtained under 15 cm. of Pb is attributed to groups of particles of atmospheric origin associated with extensive showers. The other part is due to a local effect produced in the Pb by single penetrating particles. Among the particles emitted in these processes, some have the penetrating power of low-energy mesons.

See Abstr. 2392 537.591.8 : 539.172

See Abstr. 2267 538.522 : 530.19 ; 621.3.011.3

2374 538.522.2 = 3

Remark on mutual inductance of co-axial circular rings. ROGOWSKI, W. *Arch. Elektrotechn.*, 35, *pp.* 752–755, *Dec.* 31, 1941.—An approx. formula is derived for determining the mutual inductance of co-axial circular rings which shows the dependence of mutual inductance on the diameters and the distance of the rings. Although the mutual effect is small if the distance is large, there are cases when it must be taken into account. The usual method of calculation by means of elliptical integrals becomes unsatisfactory while the approx. method leads to values sufficiently exact for practical purposes. The range for which the formula is applicable is discussed. R. N.

2375 538.542 : 621.3.018.44 = 3

Skin effect in cylindrical conductors of elliptical section at high frequencies. LETTOWSKY, F. *Arch. Elektrotechn.*, 35, *pp.* 643–662, *Dec.* 15, 1941.—[Abstr. 1164 B (1942)].

See Abstr. 2456 538.61 : 541.182.6

2376 538.74 + 522.41 + 531.74 + 531.76] : 527.6

Examination of German aircraft navigation instruments. POSTLETHWAITE, F. *J. Sci. Instrum.*, 19, *pp.* 97–101, *July*, 1942.—The following are described—the Plath projection compass, a direction-finding instrument; a spirit-level sextant and integrating device, combining a planimeter for averaging; a Plath periscopic drift sight, for measuring drift angle and ground speed; a Baum height proximeter, apparently intended to measure heights when mine-laying; and a Bruhn air-speed indicator. Few new ideas are found, but design and workmanship are good. E. H. W. B.

MOLECULAR AND ATOMIC PHYSICS

See Abstr. 2476 539.11 : 532.614.2 : 548

2377 539.13 : 539.213.2 : 539.374

The structure and constitution of glass. PRESTON, E. *J. Soc. Glass Technol.*, 26, *pp.* 82–107 (*T*), *April*, 1942.—In viscous silicates 4 O atoms are attached to a Si atom forming a tetrahedral unit, which is the fundamental unit of structure in glassy as well as in crystalline silicates. There are certain reservations, as yet incompletely considered, attaching to the random-network theory. The persistence of the SiO_4 tetrahedra in glassy silicates is the significant fact which emerges from the X-ray investigations, and on this simple result alone a plausible explanation is afforded of many of the properties of glasses.

2378 539.132

A quantum mechanical investigation of the orientation of substituents in aromatic molecules. WHELAND, G. W. *J. Amer. Chem. Soc.*, 64, *pp.* 900–908, *April*, 1942.—The treatment, which is based upon the molecular orbital method, centres attention not upon the charge distributions in the isolated molecules, but upon the energies of those structures contributing to the activated complex, in which a covalent bond is formed between the aromatic ring and the reagent. With the use of reasonable values for the various parameters that enter the calculations, complete qualitative agreement is obtained with the empirical rules of orientation.

2379 539,133

The dipole moments and structures of diketene and of certain acid anhydrides and related oxygen and sulphur compounds. OESPER, P. F., AND SMYTH, C. P. *J. Amer. Chem. Soc.*, 64, *pp.* 768–771, *April*, 1942.—The dipole moments were measured in benzene solution. The moment of diketene agrees closely with the values calculated for its most probable structures and does not serve to distinguish between them. The cyclic acid anhydrides have larger moments than similar alicyclic anhydrides because their major dipoles are forced by the rings to point more nearly in the same direction. The aromatic anhydrides have their moments increased by resonance contributions from highly polar structures. The peroxide and persulphide have much lower moments than the anhydrides. The disulphone has a large moment consistent with a structure consisting of 2 tetrahedra sharing an apex.

2380 539.133 : 537.226.2

The reduction of dipole moment by steric hindrance in di-*t*-butylhydroquinone and its dimethyl ether. OESPER, P. F., SMYTH, C. P., AND KHARASCH, M. S. *J. Amer. Chem. Soc.*, 64, *pp.* 937–940, *April*, 1942.—The dipole moments were measured with the object of studying the steric effects of the bulky *t*-butyl groups upon the adjacent hydroxy or methoxy groups. The moments were obtained by means of the apparatus and methods previously described [Abstr. 229 (1940)] the dielectric const. at 520 kc./s. and the densities of solutions of the substances in benzene being determined. The benzene was purified by standard methods.

2381 539.133 : 537.226.2 : 531.756

Electric moments of some organomercuric halides in dioxane. CURRAN, B. C. *J. Amer. Chem. Soc.*, 64, *pp.* 830–833, *April*, 1942.—Dielectric constants and densities are reported. Dielectric data are shown to be consistent with the postulate of dipole-dipole bonds between oxygen and mercury in dioxane solutions of the mercuric halides.

See Abstr. 2463 539.133 : 541.25

See Abstr. 2478 539.152 : 539.3 : 519.47 : 548.7

2382 539.152.1

Eigenfunctions in Heisenberg approximation of the two-electrons problem. PINCHERLE, L. *Phil. Mag.*, 33, *pp.* 462–466, *June*, 1942.—The analytical expression of the eigenfunctions in Heisenberg's approximation of the 2 electrons problem is given, and an application made to the $(1s)^2$— and $(2p)^2$— states of He.

See Abstr. 2416 539.153 : 541.57 : 536.66 : 541.11

See Abstr. 2393 539.155.2 : 539.172

2383 539.16.08

A water jet counter. BARAVE, R. V. *J. Univ. Bombay*, 10, *pp.* 173–174, *March*, 1942.—[See Abstr. 1114 (1935)].

2384 539.163 : 55

Geological applications of nuclear physics. GOODMAN, C. *J. Appl. Phys.*, 13, *pp.* 276–289, *May*, 1942. —A general survey is made of distribution and properties of terrestrial materials. Two methods are used to measure the age of rock samples, involving measurements of radiogenic Pb (mass-spectrographic method) or He (magnetite tests). Geophysical measurements of resistivity and natural potential give the best results on sub-surface formations. The use of nuclear physics in determining the origin of oil may lead to a new era in petroleum prospecting. R. S. R.

2385 539.163.2

Theoretical half-lives of forbidden β-transitions. GREULING, E. *Phys. Rev.*, 61, *pp.* 568–577, *May* 1 *and* 15, 1942.—Fermi's theory of β-decay is extended to the nth forbidden approximation. Precise formulae for the distribution in energy of the emitted β-rays are derived for arbitrarily charged nuclei, according to the 5 possible invariant forms of interaction. The nuclear matrix elements of the transitions, made up of the components of certain irreducible tensors, are constructed. The magnitudes of the nuclear matrix elements are estimated by a simple averaging process depending only on the directional properties of the tensors from which they are constructed and the order of magnitude of the tensor components. Theoretical $\frac{1}{2}$-lives of the forbidden β-decays of RaE, P^{32}, K^{40}, and Rb^{87} are calculated by numerical integration of the energy dependent electron emission probabilities.

2386 539.163.2

Beta-ray spectra of scandium. SMITH, G. P. *Phys. Rev.*, 60, *pp.* 578–583, *May* 1 *and* 15, 1942.—The positron spectrum of Sc^{4}, and the electron spectrum of Sc^{48} have been measured by a spectrometer of high resolution. A Kurie plot of the spectra shows that neither satisfies the Fermi distribution for an allowed disintegration. The max. energy of the positrons is $(1{\cdot}45 \pm 0{\cdot}01)$ eMV, and of the electrons (640 ± 4) ekV. The positron decay curve may be resolved into 2 components, of 4 hr. and 52 hr. $\frac{1}{2}$-life, due to a 52 hr. γ-ray transition to the 4 hr. Sc^{44} positron-emitting level. The conversion coeff. of the γ-ray is $0{\cdot}070 \pm 0{\cdot}012$, corresp. to a change of angular momentum of 3 units in the transition. The excitation energy of the γ-ray for deuteron bombardment has been obtained as $(4{\cdot}0 \pm 0{\cdot}2)$ eMV.

2387 539.163.2

Absence of high-energy beta-rays from Br^{82}. DEUTSCH, M. *Phys. Rev.*, 61, *p.* 672, *May* 1 *and* 15, 1942.

See Abstr. 2366 539.166.2 : 537.533.72

2388 539.166.835

Formation of pairs in gases by γ-rays from ThC″. GROSHEV, L. V. *J. Phys., U.S.S.R.*, 5, 2–3, *pp.* 115–136, 1941.—Pair formation in N, Kr and Xe in a Wilson chamber by γ-rays from ThC″ is investigated. The probability of this process and distribution of energy of the particles and the pairs are determined as well as the spatial distribution of direction of emission of the pair particles. The question of the impulse communicated to the atomic nucleus is considered.

2389 539.168 : 550.361

Radioactive heat generation in rocks. BULLARD, E. C. *Mon. Not. Roy. Astr. Soc., Geophys. Suppl.*, 5, 2, *pp.* 41–47, 1942.—The heat generation by Ra, Th and K is considered. The value for K is considerably less than those previously accepted, and only 5–10% of the heat generated by radioactivity in a rock is produced by K.

2390 539.172

Cross-section measurements for disintegrations produced by deuterons in the heavy elements. KRISHNAN, R. S., AND NAHUM, E. A. *Proc. Roy. Soc. A*, 180, 982, *pp.* 321–332, *June* 5, 1942.—The cross-sections have been measured for reactions produced by deuterons in Pt, Au, Hg, Tl, Pb, Bi, Th and U, using deuterons of 9 eMV energy from the cyclotron. The observed values of σ for the (d, p) reaction vary from 30×10^{-27} cm.^{2} for Pt to 5×10^{-27} cm.^{2} for U. The values for the (d, n) reaction are about $\frac{1}{4}$ of those for the (d, p) reaction. Calculations of the cross-sections to be expected on theoretical grounds have been made for 2 different values of the std. nuclear radius R_0.

2391 539.172

Excitation function measurements for disintegrations produced by deuterons in the heavy elements. KRISHNAN, R. S., AND NAHUM, E. A. *Proc. Roy. Soc. A*, 180, 982, *pp.* 333–345, *June* 5, 1942.—Excitation-function measurements have been made for the (d, p) reaction in Tl, Pb, Bi and Th, and also for the (d, n) reaction in Tl and Bi, using deuterons up to 9 eMV energy from the cyclotron. The previous results concerning the (d, p) reaction in Pt, Au and U and the (d, n) reaction in Au are also included for purposes of comparison. The energy-yield curves obtained are compared with those to be expected on theoretical grounds. The excitation function for the (d, n) reaction is approx. as predicted by the Gamow penetration theory. The Gamow process is responsible for very little if any of the yield of the (d, p) reaction which occurs mainly by the Oppenheimer–Phillips process. The observed ratio of the (d, p) yield to (d, n) yield at 9 eMV and its variation with deuteron energy are shown to favour the lower of the two values of the std. nuclear radius, namely $1{\cdot}4 \times 10^{-13}$ cm. and $2{\cdot}0 \times 10^{-13}$ cm., which have been considered in this paper.

2392 539.172 : 537.591.8

Angular distribution for the interaction of mesons with nuclei. FEINBERG, E. L. *J. Phys., U.S.S.R.*, 5, 2–3, *pp.* 177–183, 1941.—Influence of nuclear dimensions on the angular distribution is considered for the processes which include the interaction of mesons with nuclear particles, this interaction being either of the Coulomb or of the nuclear type.

2393 539.172 : 539.155.2

Radioactive isotopes of praseodymium. DEWIRE, J. W., POOL, M. L., AND KURBATOV, J. D. *Phys. Rev.*, 61, *pp.* 564–567, *May* 1 *and* 15, 1942.—New nuclear reactions $Pr^{141}(dp)$, $Ce^{142}(pn)$, and $La^{139}(\alpha n)$

yielding radioactive isotope Pr^{142} have been observed. The decay curves obtained for Pr^{142} after chemical purifications showed a ½-life of (19·3 ± 0·1) hr., a value considered to be more exact than that previously reported. The negative β-ray spectrum was measured with a recently constructed magnetic spectrometer of the 180° focusing type and was found to have an endpoint of (2·14 ± 0·02) eMV. A weak γ-ray approx. 1·9 eMV was found associated with this period. The isotope Pr^{140} has been formed by the reaction: $Pr^{141}(n,2n)$. Its ½-life was measured as (3·4 ± 0·1) min. Cloud-chamber measurements yield an upper limit of (2·40 ± 0·15) eMV for its positron spectrum.

See Abstr. 2371 539.185 : 537.534

2394 539.2/8

Works on the physics of solids in the U.S.S.R. KUZNETZOV, V. D. *J. Phys., U.S.S.R.*, 5, 5–6, *pp.* 299–317, 1941.—A brief review of researches on crystallization, plasticity, brittleness, single crystals etc. with special reference to metallurgical industry.

See Abstr. 2350 539.213.2 : 532.782 : 537.226.2

See Abstr. 2377 539.213.2 : 539.374 : 539.13

2395 539.215

Open packing of spheres. MELMORE, S. *Nature, Lond.*, 149, *p.* 669, *June* 13, 1942.—Correspondence. [See Abstr. 1617 (1942)].

See Abstr. 2277 539.216.1 : 541.18 : 532.13

2396 539.216.1 : 541.182.051.3 : 677.13

The effect of variation in emulsification technique of batching oils upon the spinning and measurable characteristics of jute. PARSONS, H. L. *J. Text. Inst., Manchr*, 33, *pp.* 77–84 (*P*), *June*, 1942.—Industrial-scale trials in the spinning of 8 lb. normal jute hessian yarns have been carried out to examine the effect upon the spinning and measurable yarn characteristics of varying the emulsification method used with the batching oil. Simple and cheap methods are equally as efficacious as more expensive ones, and the production of mechanically prepared emulsions has much to commend it.

2397 539.219.2

On the state of stress in thick bars. FROCHT, M. M., AND LEVEN, M. M. *J. Appl. Phys.*, 13, *pp.* 308–313, *May*, 1942.—Results are reported from a photoelastic investigation using both elastic and frozen stress patterns. No deviation from a state of plane stress can be found in bars of thickness t with central circular holes of radius r when r/t is of the order of magnitude of about ¼ instead of unity. The factors of stress concentration remain essentially the same in thick as in thin bars.

2398 539.219.2 : 625.14

Eighth progress report of the investigation of fissures in railroad rails. MOORE, H. F. *Bull. Univ. Ill. Engng Exp. Sta., No.* 22, [38 *pp.*], 1942.—[See Abstr. 1185 B (1941)]. Measurements of the batter and hardness of end-hardened test rails after the passage of 77×10^6 tons of traffic show that the batter of leaving rails increases with amount of traffic, while that of receiving rails decreases appreciably in some cases. The hardness increases with traffic and appears to have attained a constant value at the present stage. Most of the joints now show a droop. A large number of the rails have developed weeping cracks, but fewer occurred in rails having a hardness below 400 Brinell. The development of shatter cracks in the rails depends upon the cooling of the rail from 400° to 70°F. during heat treatment and this must be carefully controlled to eliminate the shatter risk. Drop and bend tests of rails are compared. A. C. W.

See Abstr. 2356 539.231 : 537.525 : 621.385

2399 539.234 : 537.533.73

Order in the alloy Cu_3Au. GERMER, L. H., HAWORTH, F. E., AND LANDER, J. J. *Phys. Rev.*, 61, *pp.* 614–626, *May* 1 *and* 15, 1942.—Electron diffraction by the transmission method has been used to investigate superstructure as produced in the alloy Cu_3Au by various heat treatments. Thin films of this composition, which have never been heated and are not thoroughly mixed, become homogenized and develop unmistakable order when heated at 169°C. for 16 hr. Sharper superstructure rings are produced by films annealed at higher temperatures, and perfect order is developed by heating at 270°C. for 16 hr. Diffraction patterns from films which have been quenched from temperatures above 400°C. exhibit, in addition to rings of the disordered face-centred cubic structure, a very diffuse band inside the (111) ring.

2400 539.26

A new synthesis of X-ray data for crystal analysis. YÜ, S. H., LIPSON, H., WILSON, A. J. C. *Nature, Lond.*, 149, *pp.* 638–639, *June* 6; 150, *p.* 25, *July* 4, *and pp.* 151–152, *Aug.* 1, 1942.—Correspondence.

2401 539.26

An X-ray study of carbon black. BISCOE, J., AND WARREN, B. E. *J. Appl. Phys.*, 13, *pp.* 364–371, *June*, 1942.—[See Abstr. 4014 (1934)]. X-ray studies have been made of a number of carbon blacks, prepared under different conditions, and subject to various heat treatments. The patterns were made in evacuated cameras, using Cu $K\alpha$ radiation monochromated by reflection from rocksalt. The patterns consist of crystalline reflections (00*l*), and 2-dimensional lattice reflections (*hk*). The structure is one of true graphite layers arranged roughly parallel and equidistant, but otherwise completely random. The effect of heat treatment is to increase the size of the parallel layer group. The usual carbon black is not finely divided graphite. Small-angle scattering studies indicate the existence of clusters a few hundred Å in size. It is these clusters which are measured by microscope counts, by the electron microscope, and by surface areas, rather than the much smaller parallel layer groups.

2402 539.26 : 541.9

X-rays and the stoicheiometry of the proteins, with special reference to the structure of the keratin-myosin group. ASTBURY, W. T. *J. Chem. Soc., pp.* 337–347, *May*, 1942.—A lecture review of X-ray evidence in conjunction with chemical evidence and their joint bearing on protein structure or configuration of the folded polypeptide chains. The problem of co-ordinating the variability of chemical data, due to irregular constitution, with the regularity of structure is examined, and a crystallographic analogy is emphasized. N. M. B.

ELASTICITY. STRENGTH

See Abstr. 2478 539.3 : 539.152 : 519.47 : 548.7

See Abstr. 2477 539.3 : 548

2403 539.3 : 621.315.616.4

Ebonite for electrical purposes. DAYNES, H. A. *Engng Suppl. Siemens Mag., No.* 204, [4 *pp.*], *May*, 1942.—[Abstr. 1199 B (1942).

See Abstr. 2377 539.374 : 539.213.2 : 539.13

2404 539.378.3 : 548.55

Self-diffusion of zinc. MILLER, JR., P. H., AND BANKS, F. R. *Phys. Rev.*, 61, *pp.* 648–652, *May* 1 *and* 15, 1942.—Self-diffusion measurements in zinc single crystals of various known orientations and polycrystalline zinc have been made by a sectioning method with long-lived radioactive Zn^{65} as an indicator.

2405 539.382 : 548 : 669.3

The influence of crystal size and orientation upon the mechanical properties of metals in the cast condition. NORTHCOTT, L. *J. Inst. Met.*, 68, *pp.* 189–207, *June*, 1942.—Single-phase alloy test-pieces composed of columnar crystals disposed longitudinally showed low values for max. stress but high elongations; transverse columnar crystals showed a higher max. stress but low elongation; and small equi-axial crystal samples showed the highest max. stress but low to intermediate elongation. The tensile properties of 2-phase Cu-rich alloys were found to be much less affected by crystal size. Notch-bar impact properties of either the single- or 2-phase Cu-rich alloys appeared to be unaffected by either crystal size or orientation. A few tests were also made upon pure Zn and pure Mg in coarse crystal form; the mechanical properties were found to be influenced more by the orientation of the crystals than by their size.

2406 539.4.016

Relief of residual stress in streamline tierods. POLLARD, R. E., AND REINHART, F. M. *J. Res. Nat. Bur. Stand., Wash.*, 28, *pp.* 755–772, *June*, 1942.—About $\frac{3}{4}$ of the residual stress in cold-worked SAE 1 050 steel tierods was relieved by heating them 30 min. at 600°F. Cold-worked austenitic stainless steel tierods could be heated at temperatures up to 1 000°F. without lowering the important physical properties. With materials of straight 18–8 composition, the lim. heating temperature was about 900°F., because at higher temperatures precipitation of Cr carbide occurred. It is possible that materials containing additions of Ti, Cb or Mo could be heated at higher temperatures. Microscopic examination and Vickers indentation tests indicated localized differences in amount of cold-working.

2407 539.431 = 3

Fatigue strength of aluminium and aluminium alloys. IRMANN, R. *Schweiz. Arch. angew. Wiss. Techn.*, 8, *pp.* 52–64, *Feb.*, 1942.—The dependence of the fatigue limit upon the type of test employed is discussed with special reference to Al. In the usual Wöhler rotating-bending test, the fatigue-stress/number-of-cycles curve for steel becomes horizontal at about 10×10^6 cycles, but about 50×10^6 are required to give this condition with Al. In repeated bending tests on flat specimens of Al alloys (especially Al-Cu-Mg) it was found that the relationship of the axis of the test piece to the direction of rolling had a great effect on the fatigue results. The effect of heat treatment was also considered. Increase of the dia. of cylindrical specimens reduced the fatigue strength of Al-Cu-Mg alloy tested by the Wöhler method. Polished specimens gave higher fatigue-strength values than those having machine-tool marks, while the effect of corrosion of the surface was to reduce the fatigue strength. Notches on the surface reduced the fatigue strength. A summary is given showing the effect of each test condition. A. C. W.

2408 539.431

The effect of range of stress on the fatigue strength of metals. SMITH, J. O. *Bull. Univ. Ill. Engng Exp. Sta., No.* 334, [49 *pp.*], 1942.—An analysis is made of published data of the endurance limits of notched and notch-free laboratory specimens of ductile and brittle metals subjected to any type of steady stress. Non-dimensional curves are given connecting the ratio of the endurance limit to that at zero steady stress (i.e. complete reversal) with ratio of the steady stress to the ultimate tensile strength (in cases where the steady stress is a tension). A linear relationship is obtained in such a case, and the line falls from 1 at zero steady stress to 0 when the steady-stress/u.t.s. ratio is 1. A horizontal line was obtained when the endurance limit ratio was plotted against the max. stress of the range expressed in terms of the compressive or shear strengths. Stress concentration factors are deduced for calculating the alternating stress in the case of notched specimens, but are not needed to compute the steady stress. A. C. W.

2409 539.433 : 534.14 : 534.15 : 534.372

Rubber in vibration. GEHMAN, S. D. *J. Appl. Phys.*, 13, *pp.* 402–413, *June*, 1942.—A machine is described for determining the vibration properties of various types of rubber mountings used for the isolation of mechanical vibrations. Resonance curves for shear, torsion and compression, are, except for minor deviations, adequately accounted for by the equation which contains a damping term $\propto$ to velocity and to $(\text{frequency})^{-1}$. The apparent static modulus of rubber in compression depends upon the shape of the piece. The same is true for the dynamic modulus. The dynamic stiffness shows the largest deviation from the static values at high shape factors. The internal friction has a linear relationship to the dynamic modulus when the shape factor is varied. This results in damping which is practically independent of the shape. The effect of temperature on the vibration properties of mounting stocks for a range $-10°$ to 160°F. was studied and curves are included showing the temperature dependence in this range.

2410 539.621

Progress report on the seizure of metals under sliding friction. DIERKER, A. H., AND SCHWARZ, W. M. *Engng Exp. Sta. News, Ohio State Univ.*, 14, *pp.* 5–10, *April*, 1942.—A testing machine is employed consisting of a test block fixed to a planer giving reciprocating motion of the order of 35 strokes/min., and a test specimen, having a bearing surface of $1\frac{1}{8}$ in. $\times$ $\frac{5}{16}$ in., is held stationary and presses on the test block under various loads. The test procedure consists of oiling the surfaces and permitting the machine to give 10 strokes under no load and then 10 under a

load of 34 lb., after which the bearing surfaces are dried. The test is then recommenced with a load of 34 lb., and this load is raised by 2½ lb. every 3 strokes until seizure occurs. The test specimens have either ground or machined surfaces, and are tested either perpendicular or parallel to the direction of the finishing process. Tests were made on 2 steels and 2 cast irons, and in all cases the highest seizure pressures were recorded with the tool marks (either grinding or machining) perpendicular to the direction of travel in the testing machine. The steels gave max. seizure pressures when their surfaces had a machined finish, while the cast irons gave best results with ground surfaces. A. C. W.

2411 539.893

Measurement of hydrostatic pressure to 30 000 kg./cm.² BRIDGMAN, P. W. *Proc. Amer. Acad. Arts Sci.*, 74, 1, *pp.* 1–10, 1940.—The h.p. apparatus has been modified to reduce frictional errors, and corrections to allow for distortion have been determined by direct measurements of the internal bore of the apparatus whilst under pressure. With these improvements the pressure needed to cause a phase change in Bi may be measured directly. At 30°C. this pressure was 25 420 kg./cm.² and at 75°C. 23 350 kg./cm.² These points were used for the calibration of a pressure gauge of the normal type. R. W. P.

2412 539.893

Linear compression of iron to 30 000 kg./cm.² BRIDGMAN, P. W. *Proc. Amer. Acad. Arts Sci.*, 74, 2, *pp.* 11–20, 1940.—Measurements were made on a sample of iron to be used as a std. when a differential method is applied to other substances. The rel. change of length at a mean temperature of 24°C. is $-dl/l_o = 1{\cdot}942 \times 10^{-7}p - 0{\cdot}23 \times 10^{-12}p^2$. The second-deg. term is $<<$ that of earlier measurements to 12 000 kg./cm.² and accords better with theory. R. W. P.

2413 539.893

The compression of 46 substances to 50 000 kg./cm.² BRIDGMAN, P. W. *Proc. Amer. Acad. Arts Sci.*, 74, 3, *pp.* 21–51, 1940.—Use is made of an improved differential method to measure the compressibilities of In, S, Se, Te, Sb, Bi and rubber, and of 39 compounds which crystallize in the cubic system and whose structural const. are known from X-ray analysis. Data to 50 000 kg./cm.² obtained at room temperature and −78·8°C. are tabulated and discussed. R. W. P.

2414 539.893

Freezing parameters and compressions of 21 substances to 50 000 kg./cm.² BRIDGMAN, P. W. *Proc. Amer. Acad. Arts Sci.*, 74, 12, *pp.* 399–424, 1942.—Measurements were made on water and 20 organic substances which are liquid under normal conditions, with the dual purpose of obtaining melting parameters over a wide range of pressures, and to obtain as extensive measurements as possible of the *p-v-t* relations of both liquid and solid phase of the same substance. The results resemble those obtained previously to lower pressures in showing no critical point in the melting curve, max. temperature or temperature asymptote. At 50 000 kg./cm.² the abs. vol. of most of the substances tested is about $\frac{6}{10}$ of the initial vol. at atm. pressure. R. W. P.

2415 539.893

Pressure-volume relations for 17 elements to 100 000 kg./cm.² BRIDGMAN, P. W. *Proc. Amer. Acad. Arts Sci.*, 74, 13, *pp.* 425–440, 1942.—The method used consists in placing the material under test in a small h.p. piezometer which consists of a cylinder with pistons projecting from either end. This piezometer is placed inside the apparatus used previously for tests to 30 000 kg./cm.² and the dimensions are such that the pressure within the piezometer reaches 100 000 kg./cm.² when the pressure in the 30 000 apparatus is between 27 000 and 30 000 kg./cm.², depending on the material. It is observed that Bi exists in 6 modifications and rather resembles water in the nature of its changes. R. W. P.

PHYSICAL CHEMISTRY

2416 541.11 : 539.153 : 541.57 : 536.66

On the strength of carbon–hydrogen and carbon–carbon bonds. STEVENSON, D. P. *J. Chem. Phys.*, 10, *pp.* 291–294, *May*, 1942.—Electron-impact critical potentials are combined with thermochemical data to obtain values for the heats of the dissociation reactions, $CH_4 = CH_3 + H$, $C_2H_6 = C_2H_5 + H$, $C_2H_6 = 2CH_3$ and $nC_4H_{10} = 2C_2H_5$. These values are compared with estimates based on kinetic and photochemical data.

See Abstr. 2322 541:123.2 : 535.375.5

2417 541.124 = 3

On the question of micellar or macromolecular mode of reaction of cellulose xanthogenate. BREDÉE, H. L. *Kolloid Z.*, 94, *pp.* 81–92, *Jan.*, 1941.—A critical review based on experiments for deciding whether the reactions during formation, solution and precipitation of cellulose xanthogenate, are better explained by micellar or macromolecular kinetics. Polarization, X-ray and viscosity tests show that the latter explanation is preferable. A bibliography of 38 publications is given. R. N.

2418 541.124 = 3

The course of chemical processes in which solid substances are concerned. HÜTTIG, G. F. *Kolloid Z.*, 94, *pp.* 137–147, *Feb.*, 1941.—An historical introduction to a series of papers on the principal empirical material underlying the theory of the active state. R. N.

2419 541.124 = 3

The species of chemical reactions and their classification. HÜTTIG, G. F. *Kolloid Z.*, 94, *pp.* 258–283, *March*, 1941.—[See Abstr. 2418 (1942)]. For characterizing a reaction the number of "parts" and of "states" are used; 2 reactions are considered to belong to the same species if they are characterized by the same number of parts and have the same number of solid, liquid and gaseous states at the beginning and end, respectively, of the reaction. A systematic framework is given consisting of 5 classes corresponding to 5 parts, each class being subdivided into a certain number of tribes depending on the kind of change of state. The tribes are subdivided into single kinds of reactions. A bibliography of 172 publications is given. R. N.

2420 541.124 = 3

Preparation and reactions of free methyl at low temperatures. SEMERANO, G., AND RICCOBONI, L.

Z. phys. Chem. A, 189, *pp.* 203–218, *Oct.*, 1941.—The free methyl radical was obtained by thermic decomposition of $AgCH_3$ at a temperature of $-40°C.$, special care being taken to exclude the presence of air. The apparatus is described and illustrated. At this low temperature the only reaction occurring with the free radical is its dimerization leading to C_2H_6. The test results are discussed theoretically, especially with regard to activation energy. R. N.

2421 541.124

Halogen addition to ethylene derivatives. I. Bromine additions in presence of bromide ions. II. Mechanism of the halide-ion catalysed addition reaction. III. Bromine and iodine additions in glacial acetic acid. NOZAKI, K., AND OGG, JR., R. A. *J. Amer. Chem. Soc.*, 64, *pp.* 697–716, *March*, 1942.—The equilibrium const. for the dissociation of KBr_3 in glacial acetic acid was determined at 3 different temperatures. The reaction of Br with maleic and fumaric acids in presence of LiBr with glacial acetic acid as solvent gives *trans* addition products. A reaction-rate expression is obtained. LiBr and HBr exert the same catalytic effect on the reaction of Br with allyl chloride but not on the reaction of Br with allyl acetate. The allyl-chloride–Br and the allyl-acetate–I reactions are catalysed also by other ions such as acetate, $-NO_3$, and $-HSO_4$. The Br–allyl-chloride reaction is complex, as indicated by a mixture of products and the rate expression. The rate is greatly affected by the addition of small amounts of H_2O to the solvent, but is unaffected by O_2 or packed reaction vessels. Similar results are found for the Br–allyl-acetate and I–allyl-acetate reactions. Many known anomalies are explained by the complex rate expression. Mechanisms for the reactions corresponding to the terms in the rate expression are discussed. N. M. B.

2422 541.124.7

The exchange reaction between simple alkyl iodides and iodide ion. SEELIG, H., AND HULL, D. E. *J. Amer. Chem. Soc.*, 64, *pp.* 940–948, *April*, 1942.—The rate of exchange of iodine between ethyl, propyl and isopropyl iodides and sodium iodide in alcohol solution has been studied over a temperature range from 50° to 70°, using ^{128}I as a radioactive indicator for the reaction. The radioactive samples were measured in the form of silver iodide, the precipitate being collected quantitatively in a thin layer on a filter paper which was exposed to a β-ray counter. An energy of activation has been calculated for each compound.

See Abstr. 2287 541.124.7 : 536.421.4 : 536.532 : 532.77

2423 541.126

Experimental criteria for the recognition of chain-thermal explosions. DAINTON, F. S. *Trans. Faraday Soc.*, 38, *pp.* 227–238, *June–July*, 1942.—Thermal and isothermal mechanisms of explosions and the intrinsic differences between them are described. Nine experimental tests are given which are based on this difference, and which may be used to identify an explosion as either chain-thermal or chain-isothermal.

2424 541.127.1

Kinetics of gaseous reactions by means of the mass spectrometer. The thermal decomposition of dimethyl ether and acetaldehyde. LEIFER, E., AND UREY, H. C. *J. Amer. Chem. Soc.*, 64, *pp.* 994–1001, *April*, 1942.—A mass spectrometer has been used in a new method for following the course of kinetic reactions. This method has the advantages of direct identification and conc. measurements of all stable substances involved, including intermediates. The thermal decompositions of dimethyl ether and acetaldehyde have been studied by this method.

See Abstr. 2458 541.128 : 541.183.2

See Abstr. 2465 541.128 : 541.64

2425 541.128.1

Decomposition of carbon monoxide by ferromagnetic metals. OLMER, F. *J. Phys. Chem.*, 46, *pp.* 405–414, *March*, 1942.—The catalysis of CO decomposition by Fe increases from zero with rise of temperature, drops at 580°, then rises to a second max., and again drops to zero. The catalysis is attributed to surface adsorption of CO on the Fe granules. At 580° the Fe agglomerates, causing the adsorption capacity, and hence the catalysis, to decrease. If the catalyst is mixed with a neutral substance, e.g. MgO, the Fe granules are separated and the catalyst retains its activity beyond 590°. Experiments on Ni and CO confirm this hypothesis. N. M. B.

2426 541.128.1

The kinetics of the hydrogen-fluoride catalysed reaction between toluene and *t*-butyl chloride. SPRAUER, J. W., AND SIMONS, J. H. *J. Amer. Chem. Soc.*, 64, *pp.* 648–659, *March*, 1942.—The reaction is homogeneous and proceeds at a measurable rate at 25°. Under a wide range of conditions the reaction produces *p-t*-butyltoluene in practically quantitative amounts. The reaction is first order with respect to *t*-butyl chloride conc. and is approx. $\propto$ to the 5·5 power of the HF pressure. The reaction is strongly promoted by water and methanol, is retarded by HCl and is unaffected by O. Mechanisms are proposed to correlate the kinetic data quantitatively and other known chemical facts qualitatively. An hypothetical mechanism is proposed which might be called a proton transfer mechanism or a mutual acid-base catalysis.

2427 541.128.1

Catalytic oxidation of sulphite waste liquor by atmospheric oxygen. PEARL, I. A., AND BENSON, H. K. *Industr. Engng Chem.*, 34, *pp.* 436–438, *April*, 1942.—Activated carbon is an effective catalyst for the oxidation of the chemically oxidizable compounds in sulphite waste liquor by aeration; it reduces foaming, and its activity does not decrease with use in these aerations.

2428 541.128.1

Effect of catalysis upon the oxidation products of hydroxylamine. JAMES, T. H. *J. Amer. Chem. Soc.*, 64, *pp.* 731–734, *April*, 1942.—Mercurous nitrate, under proper conditions, oxidizes hydroxylamine without an induction period and produces chiefly N_2O. Addition of colloidal Hg or Ag catalyst produces a progressive increase in N yield. The product of the catalysed reaction is predominantly nitrogen.

2429 541.128.1

The effect of alkali promoter concentration on the decomposition of ammonia over doubly promoted iron catalysts. LOVE, K. S., AND BRUNAUER, S. *J. Amer.*

Chem. Soc., 64, *pp.* 745–751, *April*, 1942.—A series of doubly promoted catalysts was prepared by treating an Al_2O_3-promoted catalyst with KOH solutions of varying strengths. By adsorption measurements the total surface areas and the surface conc. of the promoters were determined for each catalyst, and the effects of temperature and gas composition on the kinetics of ammonia decomposition were investigated. The most active catalyst toward ammonia decomposition was obtained when about 30% of the catalyst surface was covered by the alkali promoter.

2430 541.128.1

The study of the action of an aluminium–aluminium-chloride catalyst in Friedel–Crafts reactions. Benzoylation. GRUMMITT, O., AND CASE, E. N. *J. Amer. Chem. Soc.*, 64, *pp.* 878–880, *April*, 1942.—A study of the products formed when an Al–$AlCl_3$ catalyst is used in the benzoylation of benzene by benzoyl chloride has shown that reduction reactions occur simultaneously. Hydrogen is the reducing agent.

2431 541.128.1 : 541.64

Catalytic dimerization of isobutene by activated copper sulphide. WASSERMANN, A., AND WELLER, W. T. *Nature, Lond.*, 149, *p.* 669, *June* 13, 1942.

2432 541.132

General theory of the iso-electric point. HILL, T. L. *J. Phys. Chem.*, 46, *pp.* 417–428, *March*, 1942.—In this purely mathematical paper a general expression is deduced for the iso-electric point of an aqueous solution containing p ampholytes, its significance is examined, and its application to the properties of the iso-electric point in relation to solubility, ionization, migration, conductivity, and change with temperature, is discussed. N. M. B.

2433 541.132

The ionization constant of benzoic acid in methanol-water mixtures. PARTON, H. N., AND ROGERS, J. *Trans. Faraday Soc.*, 38, *pp.* 238–240, *June–July*, 1942.—The ionization constant of benzoic acid was measured from 15°C. to 45°C. in 10% and 20% methanol-water mixtures by cells without liquid junction. The thermodynamic functions for the ionization process are calculated.

2434 541.133

Conductances of aqueous solutions of the hydroxides of lithium, sodium and potassium at 25°. DARKEN, L. S., AND MEIER, H. F. *J. Amer. Chem. Soc.*, 64, *pp.* 621–624, *March*, 1942.—[See Abstr. 1918 (1940)]. NaOH and KOH behave at low conc. as typical strong electrolytes; LiOH shows deviation from complete ionization.

2435 541.133.1

The determination of the transference numbers of potassium iodide from the electromotive force of iodide-iodine gravity cells. GRINNELL, S. W., AND KOENIG, F. O. *J. Amer. Chem. Soc.*, 64, *pp.* 682–686, *March*, 1942.—Precise measurements are described of the e.m.f. of gravity cells using the earth's field, with the electrode Pt, KI (excess) + I_2. The transference numbers of K^+ calculated from the measured values of the e.m.f. agree with the best modern values to within 0·5%. The potentiometer used in the measurement is described in detail; it has a range of 1540 μV in steps of 0·01 or of 160 μV in steps of 0·001

2436 541.134

The standard potential of the silver–silver-bromide electrode in anhydrous methanol at 25°. KANNING, E. W., AND CAMPBELL, A. W. *J. Amer. Chem. Soc.*, 64, *pp.* 517–519, *March*, 1942.—The potential of the cell (Pt) H_2/HBr, methanol/AgBr, Ag was measured at 25° over the conc. range 0·000474m to 0·0543m. The std. potential of the AgBr electrode in methanol solution of HBr expressed on the molality basis was − 0·1328 V, and on the molarity basis − 0·1451 V. Deviations from the Debye–Hückel imiting law are indicated by a value of 1·42 for the constant A, as compared with the theoretical value of 2·11.

See Abstr. 2439 541.135.5 : 541.138.3

2437 541.135.85 : 77

Photographic reciprocity-law failure and the ionic conductivity of the silver halides. WEBB, J. H. *J. Opt. Soc. Amer.*, 32, *pp.* 299–303, *May*, 1942.—The present theory of reciprocity-law failure at high intensities is discussed, and a method is given for determining, from law-failure measurements at different temperatures, the value of the energy exponent ε in the equation for ionic conductivity of AgBr, $N_i = Ae^{-\varepsilon/kT}$ ions/sec. By choosing points on the reciprocity curves at different temperatures such that the change of efficiency arising from a change of intensity I_1 to I_2 is equal to that arising from a change of temperature T_1 to T_2 the relation is shown to hold: $\log I_2/I_1 = \frac{0{\cdot}434\varepsilon}{k}(1/T_1 - 1/T_2)$. Substitution of experimental values in this equation gives $\varepsilon = 0{\cdot}69$, compared with $\varepsilon = 0{\cdot}66$ by measurement of ionic conductivity at different temperatures on a single crystal of AgBr. The close agreement is quantitative evidence that the high-intensity reciprocity-law failure is due to the ionic conductivity effect alone. N. M. B.

2438 541.138.3

The anomalous electro-reduction of water at the dropping mercury electrode in relatively concentrated salt solutions. ORLEMANN, E. F., AND KOLTHOFF, I. M. *J. Amer. Chem. Soc.*, 64, *pp.* 833–838, *April*, 1942.—[See Abstr. 2623 (1939)].—It is shown that a current in salt solutions of the order of 0·5 M or greater causes an electro-reduction of water at the dropping Hg electrode. The water current is ∝ the total current flowing.

2439 541.138.3 : 541.135.5

Electrolytic reduction of strychnine. ZWICKER, B. M. G., AND ROBINSON, R. J. *J. Amer. Chem. Soc.*, 64, *pp.* 790–793, *April*, 1942.—Solid metallic cathodes were found to be quite inefficient in the electrolytic reduction of strychnine. In 60% H_2SO_4, a Hg cathode gave strychnidine and tetrahydro-strychnine in excellent yields. The ratio of the two could be varied by varying the temperature and length of reduction. Sodium amalgam cathodes gave 20 to 30% dihydrostrychnidine and an even greater rate of reduction than mercury.

2440 541.141.5 = 3

Researches on photo-activity of solid substances. IX. HEDVALL, J. A., BORGSTRÖM, G., AND COHN, G. *Kolloid Z.*, 94, *pp.* 57–64, *Jan.*, 1941.—[See Abstr. 2123 (1940)]. The change in surface activity due to light absorption in a crystal is dealt with. The effect con-

sists in changing the velocity or equilibrium of processes such as sorption and catalysis. R. N.

2441 541.141.5 : 77 = 3

Chemically produced germs in silver iodide. LÜPPO-CRAMER. *Kolloid Z.*, 94, *pp.* 184–188, *Feb.*, 1941.—Treatment with a highly diluted hydrolysed solution of $SnCl_2$ leads to the formation of Ag germs on AgI gelatin plates similar to that produced by pre-exposure. Image reversal is observed, in analogy with an otherwise different process [Abstr. 4310 (1939)]. The behaviour to dyestuffs is similar for chemically and physically produced germs whereas pure layers of AgI cannot be sensitized by irradiation. R. N.

2442 541.144.7

The photocombination of hydrogen and chlorine in oxygen-free systems. RITCHIE, M., AND TAYLOR, D. *Proc. Roy. Soc. A*, 180, *pp.* 423–451, *July* 3, 1942.—The photosynthesis of HCl has been studied under varied conditions of light intensity and of H, Cl, HCl, N and A pressures. The inhibiting actions of Cl and HCl are considered confirmed. With increasing pressure of HCl, the quantum eff. decreased continuously, while with Cl and also with N and A, max. were observed at intermediate pressures, after which the quantum eff. fell progressively. With increasing light intensity at the lower pressures, the quantum eff. was found to decrease to a const. value. Further, the change in intensity exponent with increasing pressure has been investigated, and values approaching 0·5 at h.p. have been observed. In the case of HCl indices less than 0·5 were noted at the highest pressures.

2443 541.144.8

The photolysis of the aliphatic aldehydes. X. Acetaldehyde and iodine mixtures. BLACET, F. E., AND HELDMAN, J. D. *J. Amer. Chem. Soc.*, 64, *pp.* 889–893, *April*, 1942.—A study is made of the photolysis of acetaldehyde and of acetaldehyde and iodine mixtures at λ3 130 over the temperature range of 60° to 170°. The formation of free methyl and formyl groups is the only important primary dissociation process; iodine reacts readily with both methyl and formyl radicals, thus stopping all normal secondary processes; iodine does not react readily with activated acetaldehyde molecules.

2444 541.144.8

The photolysis of the aliphatic aldehydes. XI. Acetaldehyde and iodine mixtures. BLACET, F. E., AND LOEFFLER, D. E. *J. Amer. Chem. Soc.*, 64, *pp.* 893–896, *April*, 1942.—Deals with photolysis experiments on acetaldehyde and iodine mixtures in which wavelength, temperature and iodine conc., were varied one at a time while other conditions remained constant. The major portion of this work was done at λ2 654.

2445 541.144.8

The photolysis of persulphate. HEIDT, L. J. *J. Chem. Phys.*, 10, *pp.* 297–302, *May*, 1942.—The photochemical eff., ϕ, for the decomposition of persulphate by light of λ254 mμ is determined by comparison with ϕ for the uranyl oxalate actinometer. Evidence is given to show that the main reaction is not the decomposition of SO_4^-. Acetic acid increases the yield to unity but non-oxidizable ions have a depressing effect. At const. ionic strength, ϕ remains nearly unchanged in alkali, but drops abruptly to less than 0·01 when solutions are acidified, suggesting the formation of a weak acid containing photochemically inert persulphate.

2446 541.144.8

Phototropic dyes. STEARNS, E. I. *J. Opt. Soc. Amer.*, 32, *pp.* 282–284, *May*, 1942.—An analysis of 162 commercial dyestuffs in solution shows in the case of 10% of these a phototropic effect which is spectrophotometrically measurable.

2447 541.145

The photolysis of methyl acetate. ROTH, W. L., AND ROLLEFSON, G. K. *J. Amer. Chem. Soc.*, 64, *pp.* 490–494, *March*, 1942.—[See Abstr. 581 (1942)]. The mercury-sensitized and the non-sensitized photolyses of methyl acetate were studied. The products of the reaction were di-acetyl, acetone, methyl alcohol, carbon monoxide, carbon dioxide, methane, ethane and hydrogen. The principal primary process is a splitting of the ester molecule into an acetyl and a methoxy radical. The observed products are formed in secondary reactions of these radicals.

2448 541.145

Water effects upon the photochemical bromination of acetophenone. HICKS, E. M., HICKS, M. H., AND SAMPEY, J. R. *J. Amer. Chem. Soc.*, 64, *pp.* 887–889, *April*, 1942.—Rates of photochemical bromination of acetophenone in the presence of varying conc. of H_2O, HCl, P_2O_5 and S are given. The results indicate that the theory of phototropic reaction of carbonyl compounds is applicable even in non-aq. solvents, e.g. CCl_4.

2449 541.145

Zinc-photosensitized reactions of ethylene. HABEEB, H., LEROY, D. J., AND STEACIE, E. W. R. *J. Chem. Phys.*, 10, *pp.* 261–267, *May*, 1942.—An investigation has been made of the polymerization of ethylene photosensitized by Zn, both resonance lines, 2 139 Å and 3 076 Å, being used. With λ3 076 the rate of the reaction is very small, owing to inefficient quenching. With λ2 139 a rapid polymerization occurs. The rate of polymerization increases rapidly with increasing ethylene pressure.

See Abstr. 2277 541.18 : 539.216.1 : 532.13

2450 541.18.046.7 : 541.183.24 = 3

Further notes on the activity-constant theory of electrolyte coagulation of weakly solvatized hydrosols. OSTWALD, W. *Kolloid Z.*, 94, *pp.* 169–184, *Feb.*, 1941.—A mainly polemical paper refuting objections raised by Weiser and Milligan [Abstr. 2731 (1940)] and others against the activity const. theory [Abstr. 3851 (1939)]. A brief review is given of the present state of the theory with regard to coagulation processes, and its application to other phenomena in weakly solvatized systems, e.g. adhesive strength, velocity of sedimentation and filtration, volume of sedimentation, viscosity, etc., of coarsely dispersed quartz suspensions, electrolyte adsorption at carbon, etc. The activity coeff. is not only a numerical factor but has a definite physico-chemical significance. [See Abstr. 1113 (1941)]. R. N.

2451 541.182 : 667.2

The dyeing of cellulose acetate rayon with dispersed dyes. VICKERSTAFF, T., AND WATERS, E. *J. Soc. Dy. Col., Bradford*, 58, *pp.* 116–125, *June*, 1942.—Sorption isotherms for the dyeing of cellulose acetate have been determined and are shown to be curves of hyperbolic type, an indication that dyeing does not consist in the formation of a true solution of dye in the fibre up to saturation, as is the case in the partition of a dispersed dye between amyl acetate and water. Neither is the process one of adsorption, for the quantity taken up by the fibre is independent of the liquor ratio and is, therefore, a function of the weight of dye in the dyebath and not of the conc. of dye. Dyeing appears to take place by means of submicroscopic particles, a conclusion supported by the fact that dyeing can occur when the dispersion of dye is enclosed in a cellophane bag. It is shown also that the dyeing process is reversible. The observed facts are best explained on the assumption that a colloidal solution of dye is formed in cellulose acetate.

H. H. HO.

See Abstr. 2396 541.182.051.3 : 677.13 : 539.216.1

2452 541.182.5 = 3

On starch jellies. SECK, W., AND FISCHER, G. *Kolloid Z.*, 93, *pp.* 207–224, *Nov.*, 1940.—Only those starches which possess both shape elasticity and volume elasticity are considered to form jellies. In order to investigate the properties required for the formation of jellies and the relation to their behaviour as regards swelling, the starches are swollen in water, heated, and finally subjected to a mechanical treatment at high speeds of displacement. The modulus of elasticity is calculated from elastometer measurements. Of 6 species of starches only those originating from seeds, e.g. wheat, form jellies. The strength of the jelly depends on an optimum value of the state of hydration. The amylopectine content, i.e. the coarsely dispersed part of the grain, is considered as the constructive element in the formation of starch jellies. R. N.

2453 541.182.5

Hydrous cupric hydroxide and basic cupric sulphates. WEISER, H. B., MILLIGAN, W. O., AND COOK, E. L. *J. Amer. Chem. Soc.*, 64, *pp.* 503–508, *March*, 1942.—The spontaneous decomposition of cupric hydroxide gel gives brown to black cupric oxide. The decomposition of the gel is accelerated in contact with solution of dilute alkali. The rate of decomposition of relatively large crystals of cupric hydroxide is slower under all conditions than that of the minute crystals constituting the gel. The alleged stabilization of blue cupric hydroxide in the presence of low conc. of heavy metal sulphates is not a stabilization phenomenon but consists in the formation of the blue basic salt, $5CuO \cdot SO_3 \cdot xH_2O$.

2454 541.182.5 : 548.5 = 3

Limitations of the Kossel–Stranski theory of crystal growth. KLEBER, W. *Kolloid Z.*, 94, *pp.* 39–42, *Jan.*, 1941.—Objections raised by Balarew [Abstr. 1657 (1942)] against the Kossel–Stranski theory are refuted. This theory has proved very fruitful as a development of the lattice theory, and its limitations are only to be found where secondary processes, adsorption etc., play a prominent part. R, N,

2455 541.182.6 : 532.13

Sediment volumes and the specific viscosity of suspensions and solutions in mixed liquids. MARDLES, E. W. J. *Trans. Faraday Soc.*, 38, *pp.* 222–227, *June–July*, 1942.—The close similarity in the shape of the curves relating the composition of mixed liquids with (*a*) sediment volumes of finely divided solids, (*b*) the dispersion and gelation of colloidal solutions, and (*c*) sp. viscosity of the suspensions and solutions in the mixed liquids, has been traced for cellulose esters, resins, kaolin, mica, carbon black and other powders, in mixtures of acetone and water, cyclohexanone and benzyl alcohol, alcohol with acetone and benzene, and phenol with aniline and acetone.

2456 541.182.6 : 538.61

Magneto-optical properties of ferromagnetic suspensions. MUELLER, H., AND SHAMOS, M. H. *Phys. Rev.*, 61, *pp.* 631–634, *May* 1 *and* 15, 1942.—Observations on the change of light transmission through magnetite suspensions under the influence of alternating magnetic fields show that the orientation of the particles is not exclusively of dipolar origin. Fields of frequencies between 500 and 15 000 c./s. produce a steady change of absorption. In fields of lower frequencies the change consists of a steady and a fluctuating part. The wave form of the latter is studied with a photocell amplifier and an oscillograph. This behaviour is characteristic of polar anisotropic particles, for which the torque on the induced dipole is of the same order of magnitude as that due to the permanent dipole.

2457 541.182.7

The solubility of sodium palmitate in organic liquids. LEGGETT, JR., C. W., VOLD, R. D., AND MCBAIN, J. W. *J. Phys. Chem.*, 46, *pp.* 429–440, *March*, 1942.—The following factors affect the solubility of sodium palmitate: (1) the nature, number and space relationships of the polar groups of the solvent molecules, (2) the polarity of the solvent as measured by the quotient of dipole moment and molar volume, and (3) the size and shape of the solvent molecules. The colloidal nature of these systems is indicated by the formation of gels, jellies and liquid crystalline phases, by the occurrence of syneresis, and by the appearance of sharp elbows in the solubility curves, often attributed to the formation of micelles.

See Abstr. 2289 541.183 : 533.27

2458 541.183.2 : 541.128

Adsorption of nitrogen and the mechanism of ammonia decomposition over iron catalysts. BRUNAUER, S., LOVE, K. S., AND KEENAN, R. G. *J. Amer. Chem. Soc.*, 64, *pp.* 751–758, *April*, 1942.—Equations are derived for the rate of adsorption, the rate of desorption and the adsorption isotherm (*a*) when the surface is heterogeneous, and the heat of adsorption and the energies of activation of adsorption and desorption exhibit linear variations between their max. and min. values, and (*b*) when there are forces of attraction or repulsion between the adsorbed particles, and the heat of adsorption and the energies of activation of adsorption and desorption vary linearly with the fraction of the surface covered. Adsorption isotherms of nitrogen on iron catalysts are calculated from rates of adsorption data. A kinetic equation is derived for the rate of ammonia

decomposition on doubly promoted iron catalyst 931.

See Abstr. 2450 541.183.24 : 541.18.046.7

2459 541.183.26

Heats of wetting for the evaluation of gas-adsorbing coconut carbons. STONE, H. W., AND CLINTON, R. O. *Industr. Engng Chem.* (*Analyt. Edit.*), 14, *pp.* 131–135, *Feb.* 15, 1942.—An improved method is developed by means of the relation between the heat of wetting and other analytical factors. Modified methods for the determination of adsorption values, retentivity and heats of wetting, are given. E. H. W. B.

2460 541.183.26

Sorption of water vapour by vermiculite and its silica. SPITZE, L. A., AND HANSEN, L. A. *Industr. Engng Chem.*, 34, *pp.* 506–508, *April*, 1942.—By the use of a McBain–Bakr sorption balance, isotherms were obtained at 25°, 45° and 65°C., for the sorption of water vapour by vermiculite, exfoliated vermiculite and the silicas prepared from these materials. Definite hysteresis was observed in the isotherms for the silicas but was absent in those of unexfoliated and exfoliated vermiculite.

2461 541.25 : 531.756

Molal volumes of solutes. VI. Potassium chlorate and hydrochloric acid. REDLICH, O., AND BIGELEISEN, J. *J. Amer. Chem. Soc.*, 64, *pp.* 758–760, *April*, 1942.—The densities of aq. solutions of $KClO_3$ and HCl have been determined with a precision of approx. 4×10^{-7} in the range of high dilution. The limiting law of the molal volume has been confirmed.

2462 541.25 : 531.756

Molal volumes of solutes. VII. Sodium acetate and acetic acid. REDLICH, O., AND NIELSEN, L. E. *J. Amer. Chem. Soc.*, 64, *pp.* 761–762, *April*, 1942.—[See Abstr. 621 (1941)]. The apparent molal volumes of sodium acetate and acetic acid in aq. solutions at 25.00°, required for a test of Born's equation, have been determined with an estimated uncertainty of 0·03 and 0·01 cm.^{3}/mole, respectively.

2463 541.25 : 539.133

Apparent volumes of individual ions in aqueous solution. FAJANS, K., AND JOHNSON, O. *J. Amer. Chem. Soc.*, 64, *pp.* 668–678, *March*, 1942.—A partition of the apparent molar volumes of strong electrolytes into values of individual ions is made on the basis of the behaviour of aq. NH_4Cl near 35°. It is concluded that near 35°, NH_4 and Cl ions both fit into the structure of liquid H_2O. For ions which are either much larger (ClO_4^-) or smaller (Na^+) than H_2O molecules, the thermal expansibility of their aq. solutions is strongly influenced by the breaking of the loose H_2O structure. The displacement of protons within H_2O molecules and within the NH_4 and OH ions is brought into relation with the mechanism of hydration of ions and molecules. Comparison of anions with cations and of ions of different structure shows that the gradation of their apparent volumes in aq. solution can differ considerably from that of their size in crystals. N. M. B.

See Abstr. 2416 541.57 : 539.153 : 536.66 : 541.11

2464 541.571

The carbon-hydrogen bond strengths in methane and ethane. ANDERSEN, H. G., KISTIAKOWSKY, C. B., AND ARTSDALEN, E. R. VAN. *J. Chem. Phys.*, 10, *p.* 305, *May*, 1942.—Activation energies of simple steps which can be used to calculate the upper limits of the binding energies of the systems CH_3-H and C_2H_5-H are calculated.

2465 541.64 : 541.128

Methyl methacrylate polymerization. ALYEA, H. N., GARTLAND, JR., J. J., AND GRAHAM, JR., H. R. *Industr. Engng Chem.*, 34, *pp.* 458–460, *April*, 1942.—Polymerization of methyl methacrylate at 80°C. in the presence of peroxide catalysts, with and without hydroquinone inhibitor, was followed by density measurements. Polymerization is $\propto \sqrt{\text{peroxide conc.}}$ The oxidation of hydroquinone to quinone, confirmed by light-transmission curves, is independent of the hydroquinone conc. and dependent on peroxide conc. The results are consistent with the following mechanism: The peroxides initiate reaction chains; the hydroquinone breaks these chains and in so doing becomes oxidized to quinone.

See Abstr. 2431 541.64 : 541.128.1

2466 541.653.3

The mutarotation of α-D-glucose in dioxane-water mixtures at 25°. ROWLEY, H. H., AND HUBBARD, W. N. *J. Amer. Chem. Soc.*, 64, *pp.* 1010–1011, *April*, 1941.

2467 541.8 : 536.75 : 536.653

The partial pressure of hydrogen chloride from its solutions in β,β′-dichloroethyl ether and in anisole and the calculation of the heat and entropy of solution. O'BRIEN, S. J. *J. Amer. Chem. Soc.*, 64, *pp.* 951–953, *April*, 1942.—Measurements of the partial v.p. of HCl from its solutions in β,β′-dichloroethyl ether and in anisole in the range of 20°–40° are reported [Abstr. 280 (1942)]. The v.p. measurements are used to calculate the mole fraction solubility of HCl in these solvents at a partial pressure of 1 atm. These solubilities, which fit an equation of the form $\log N = A/T + B$, are used to obtain the differential heat and entropy of solution. The entropy values so obtained are in agreement with those derived from infra-red absorption data and an equation connecting the thermodynamic with the spectroscopic quantity.

See Abstr. 2402 541.9 : 539.26

2468 542.3

Testing of glass volumetric apparatus. PEFFER, E. L., AND MULLIGAN, G. C. *Circ. U.S. Bur. Stand.*, *C* 434, [27 *pp.*], 1941.—Contains specifications and tolerances for glass volumetric apparatus of precision grade. Detailed information is given on dimensions, type of graduations, inscriptions and tolerances for burettes, flasks, cylinders and certain kinds of special apparatus. Instructions are given for the method of reading, the test liquid used, the method of test, and the importance of cleanliness of apparatus. An outline of the tests performed, reports of test and directions for submitting apparatus, are included.

2469 542.48

Apparatus for distillation of corrosive liquids. HIXSON, A. W., AND TENNEY, A. H. *Industr. Engng Chem.* (*Analyt. Edit.*), 14, *p.* 345, *April* 15, 1942.

2470 542.8 = 3

Automatic recording of hydrogen-ion concentration (pH values). KUNTZE, A. *VDI* [*Z. Ver. dtsch. Ing.*],

84, *pp.* 755–759, *Oct.* 5, 1940.—After reviewing the principles of *p*H measurements and the electrodes used for automatic recording, the author describes a reliable recording appliance suitable for all liquid solutions between 15° and 40°C. and giving accurate measurements without requiring much attendance. The appliance uses a glass diaphragm, 2 saturated calomel electrodes and a sensitive automatically equalizing compensator working by means of a photocell. Temperature compensation is obtained by a Pt resistance having the same positive temperature coeff. as the p.d. generated by the difference of the *p*H values of the solution to be measured and the standard solution. R. N.

CRYSTALLOGRAPHY

See Abstr. 2363 548 : 535.3 : 537.531

2471 548 : 535.4.

Crystal dynamics of rocksalt. LONSDALE, K. *Nature, Lond.*, 149, *pp.* 698–699, *June* 20, 1942.

See Abstr. 2364 548 : 535.4 : 537.531

2472 548 : 536.631

Note on Raman's theory of the specific heat of solids. BLACKMAN, M. *Proc. Phys. Soc., Lond.*, 54, *pp.* 377–379, *July*, 1942.—Raman's version of the theory of the sp. ht. of solids is examined [Abstr. 1675 (1942)]; it is shown that the existing (lattice) theory gives better agreement with experiment.

2473 548 : 536.631

Raman's theory of specific heat of crystals. BLACKMAN, M., AND BORN, M. *Nature, Lond.*, 150, *p.* 55, *July* 11, 1942.—A criticism.

2474 548 : 537.531 : 535.4

Lattice dynamics and X-ray scattering. BORN, M. *Proc. Phys. Soc., Lond.*, 54, *pp.* 362–376, *July*, 1942.—A refutation of Raman's criticism of the theory that the extra spots on Laue photographs are due to the thermal motion of the crystal lattice, and a theoretical confirmation that these spots are in fact due to the l.f. (acoustic) vibrations of the elastic spectrum. Raman criticizes the theory of lattice vibrations on account of the use made of the method of the cyclic lattice, but it is shown that the cyclic solution is in complete agreement with the rigorous solution in the case of a diatomic linear lattice where an optical branch exists in addition to the acoustic one. A short account is given of the results of the dynamical theory obtained by Zachariasen, Jahn and Sarginson, which are in good agreement with the experiments of Lonsdale and Smith, Zachariasen and others. J. T.

2475 548 : 537.531 : 535.4

Note on the comparison of the subsidiary maxima in electron diffraction and X-ray diffraction patterns from single crystals. CHARLESBY, A. *Proc. Phys. Soc., Lond.*, 54, *pp.* 379–387, *July*, 1942.—The occurrence of diffuse bands in electron diffraction and their apparent non-appearance in X-ray diffraction is accounted for by differences in wavelength, intensity, crystal size, etc. A qualitative comparison is made of the Faxén–Waller theory, used to explain extra spots in the X-ray diffraction pattern, with the hypothesis advanced to account for the presence of diffuse bands.

2476 548 : 539.11 : 532.614.2

Energy relations of the surface of solids. I. Surface energy of the diamond. HARKINS, W. D. *J. Chem. Phys.*, 10, *pp.* 268–272, *May*, 1942.—From the known structure of the diamond the total surface energy of the crystal has been calculated in terms of the energy of the C-C bond. One uncertain feature in the calculation is that involved in the calculation of the decrease in energy caused by the long-range binding of the valence bonds in the surfaces.

2477 548 : 539.3

On the theory of finite deformations of elastic crystals. FÜRTH, R. *Proc. Roy. Soc. A*, 180, 982, *pp.* 285–304, *June* 5, 1942.—The general theory of finite deformation of cubic crystals at zero temperature is developed to a second-order approximation, and the cases of (1) a uniform hydrostatic pressure, (2) a tension in the direction of one of the axes, (3) a shear along the (0, 1, 0) planes, and (4) a shear along the (0, 1, 1) planes of the lattice, are worked out in detail. A number of "second-order effects" (deviations from Hooke's law) are predicted which in case (1) have been observed and measured by Bridgman, and in the remaining cases certainly can be detected and measured by suitable experimental arrangements. The const. governing the second-order effects are expressed in terms of the const. governing the force law, and calculated numerically for a number of special values of these const.

See Abstr. 2405 548 : 669.3 : 539.382

See Abstr. 2454 548.5 : 541.182.5

See Abstr. 2337 548.55 : 536.413

See Abstr. 2365 548.55 : 537.533.7

See Abstr. 2404 548.55 : 539.378.3

2478 548.7 : 539.152 : 539.3 : 519.47

Crystal theory of metals: calculation of the elastic constants. FUCHS, K., AND PENG, H. W. *Proc. Roy. Soc. A*, 180, *pp.* 451–476, *July* 3, 1942.—The approx. equations of motion for the electrons in a cyclic lattice of a metal are set up with the help of the self-consistent field. The displacements of the ions are considered as perturbations of the motion of the electrons. The change of the boundary is compensated by a co-ordinate transformation. The change of the potential energy of the lattice due to a homogeneous deformation is calculated by the perturbation method. The calculated values of the elastic const. are found to be in satisfactory agreement with the observed values.

2479 548.73

X-ray study of crystal dynamics. LONSDALE, K. *Proc. Phys. Soc., Lond.*, 54, *pp.* 314–348; *Disc.*, 348–353, *July*, 1942.—An outline is given of the reciprocal-lattice method of relating X-ray reflections to the density distribution in the crystal. The experimental work is described, and it is shown that a spreading of the reflecting power outside the reciprocal-lattice points is proved. The simple diffraction theory, the Faxén–Waller theory and the Raman theory are sketched and related to recent experimental work. A description is given of the anomalous effects for diamond, and it is shown that only the Faxén–Waller theory can account for the results observed for

crystals of all kinds, and especially for single crystals of metals.

2480 548.73

The secondary X-ray spectrum of sylvine: theory and experiment. BRAGG, W. *Proc. Phys. Soc., Lond.*, 54, *pp.* 354–361, *July*, 1942.—The co-existence in a crystal of very large and very small groups of atoms, the atoms within any group being in correct relative positions, but out of alignment with the atoms of neighbouring groups, so that all phase relationships between the scattered X-ray waves from successive groups is lost, would give both sharp spots and diffuse-background spots on a Laue photograph. This hypothesis predicts nearly circular diffuse spots for KCl at small angles of total deflection, whereas the Faxén–Waller theory predicts elongated ellipsoids of max. intensity at the centre. In this respect the hypothesis that the crystal is broken up into groups of atoms, with loss of continuity in phase relationship, is in better accord with observation than the hypothesis that it remains a single crystal distorted by the heat waves, but with no loss of continuity.

2481 548.73

The crystal structure of β-isoprene sulphone. COX, E. G., AND JEFFREY, G. A. *Trans. Faraday Soc.*, 38, *pp.* 241–247, *June–July*, 1942.—A detailed X-ray analysis shows that the molecule of β-isoprene sulphone has a heterocyclic structure in which resonance occurs between the 3 C-C bonds of the C_4S ring.

2482 548.73

Imperfections in the structure of cobalt. I. Experimental work and proposed structure. EDWARDS, O. S., AND LIPSON, H. *Proc. Roy. Soc. A*, 180, 982, *pp.* 268–277, *June* 5, 1942.—X-ray powder photographs of hexagonal cobalt have a remarkable mixture of sharp and diffuse lines. The sharp lines are those with $\frac{1}{3}(h - k)$ integral and those with l zero; all others are more or less diffuse. An explanation of this is produced, based on the possibility of faults occurring in the structure because there are 2 different ways in which one close-packed layer of atoms can be put on to another. It is shown theoretically that if such faults are repeated at regular intervals, the reflections with $\frac{1}{3}(h - k)$ integral are not affected, but the positions and intensities of the other lines are modified although they remain sharp. These results suggest that a structure with random faults would give broadened reflections, but the broadening is such that it would not show for lines with l zero on powder photographs.

2483 548.73

Imperfections in the structure of cobalt. II. Mathematical treatment of proposed structure. WILSON, A. J. C. *Proc. Roy. Soc. A*, 180, 982, *pp.* 277–285, *June* 5, 1942.—The close-packed structures are made by piling up close-packed planes of atoms in 3 different rel. positions. In proper hexagonal close-packing only 2 of the positions are used. The intensity of reflection of X-rays is calculated for a structure which usually follows the hexagonal scheme, but has occasional faults introducing the third position. This model gives a satisfactory explanation of the measured integral breadths of certain reflections from hexagonal cobalt. The affected reflections with l even are broadened more than those with l odd. The total intensity of the reflections is not greatly changed.

GEOPHYSICS

See Abstr. 2384 55 : 539.163

2484 550.341

The times of *sP* and *sPKP*. JEFFREYS, H. *Mon. Not. Roy. Astr. Soc., Geophys. Suppl.*, 5, 2, *pp.* 31–32, 1942.—A correction [Abstr. 1079 (1940)].

2485 550.341

The deep earthquake of 1934 June 29. JEFFREYS, H. *Mon. Not. Roy. Astr. Soc., Geophys. Suppl.*, 5, 2, *pp.* 33–36, 1942.—The data for this earthquake do not support the great focal depth of $0{\cdot}11R$ previously attributed to it. A solution from *P*, *S* and *SKS* together indicates a depth of $0{\cdot}0969R \pm 0{\cdot}0007R$. Numerous observations of *PKP* on the receding branch provide a check on the empirical times derived from this branch from a previous earthquake; the tabulated times need an increase of about 0·9 sec.

A. HU.

See Abstr. 2496 550.342 : 551.593.9

See Abstr. 2389 550.361 : 539.168

See Abstr. 2243 550.385 : 523.75

2486 550.423

On the radioactivities of rocks. (Second Paper). JEFFREYS, H. *Mon. Not. Roy. Astr. Soc., Geophys. Suppl.*, 5, 2, *pp.* 37–40, 1942.—Discussion of the proportional scatter of the amounts of Ra and Th in relation to the means for N. American rocks shows that it is larger than in series for rocks of the same types when the rocks are classified by regions before making summaries. It is concluded that N. America cannot be regarded as a single unit in the discussion of terrestrial radioactivity. [See Abstr. 2660 (1936)].

2487 551.501 : 551.591

The relation between the stellar magnitude of a light and the number of nebules needed to reduce it to a standard intensity. BULL, G. A. *Quart. J. Roy. Met. Soc.*, 68, *pp.* 190–192, *April*, 1942.—[See Abstr. 2454 (1939)].

2488 551.501.45 : 551.524.3 : 551.543

The problem of auto-correlation of meteorological time series, illustrated by examples from some South African stations. SCHUMANN, T. E. W., AND HOFMEYER, W. L. *Quart. J. Roy. Met. Soc.*, 68, *pp.* 177–188, *April*, 1942.—In the case of temperatures, it was found that, provided any daily or seasonal fluctuations are first eliminated and the standard deviation is constant, the coeff. of auto-correlation R' has the analytic form $R' = e^{-ky}$, in which k is a const. and y is the time-lag. If, however, there is a marked variation in the standard deviation, such as is nearly always present in hourly values of temperature, R' is a function not only of the time-lag, but also of the actual times marking the beginning and end of the time-lag under consideration. In the case of a series of pressure readings R' is not a simple exponential function, but may contain one or more damped harmonic terms.

2489 551.506.1

Meteorological observations at the Royal Observatory, Greenwich, during the year 1941. *Quart. J. Roy. Met. Soc.*, 68, *pp.* 189–190, *April*, 1942.

2490 551.506.3 : 551.585.7

Meteorologica observations on Dun Fell, a mountain station in northern England. MANLEY, G. *Quart. J. Roy. Met. Soc.*, 68, *pp.* 151–162; *Disc.*, 162–

166, *April*, 1942.—Meteorological observations have been kept (1937–40), including a continuous record of temperature. Estimates of the longer-period averages are made for several climatic elements and compared with those from summit stations elsewhere. It is emphasized that over longer periods of time considerable variations in the upland climate are likely to occur as a result of small changes in the average distribution of pressure and that these will react considerably upon the vegetation.

2491 551.510 : 523.4

The atmospheres of the planets. JONES, H. SPENCER. *Quart. J. Roy. Met. Soc.*, 68, *pp.* 121–150, *April*, 1942.—The means by which planetary atmospheres can be investigated are outlined: theoretical methods concerning the escape of gases from the gravitational field and the estimation of surface temperatures complement observational data obtained both by direct photography in light of various wavelengths and by spectroscopy. A detailed review of our knowledge of the atmospheres of the Moon, Mercury, Mars, Venus and the major planets, shows that the problem of their nature is now solved in its broad outlines: the atmospheres differ considerably from one another, but their extent and their composition are in general accordance with expectation. A. HU.

See Abstr. 2493 551.511 : 551.574

2492 551.521.1 : 621.181.6 : 621.311.2

The performance of flat-plate solar-heat collectors. HOTTEL, H. C., AND WOERTZ, B. B. *Trans. Amer. Soc. Mech. Engrs*, 64, *pp.* 91–103; *Disc.*, 103–104, *Feb.*, 1942.—[Abstr. 1182 B (1942)].

See Abstr. 2488 551.524.3 : 551.543 : 551.501.45

See Abstr. 2488 551.543 : 551.524.3 : 551.501.45

2493 551.574 : 551.511

Condensation caused by mixing. PETTERSSEN, S. *Quart. J. Roy. Met. Soc.*, 68, *pp.* 167–174; *Disc.*, 174–176, *April*, 1942.—The Bezold effect of mixing two parcels of unsaturated air having different temperatures, and the resulting condensation, are examined, but it is shown that for atmospheric production of fog the result is negligible. Vertical mixing is shown to decrease the rel. humidity in the lower, and increase in the upper portion of a mixed layer. The conditions for condensation are obtained. The height at which condensation may occur and the amount of condensed water contained is evaluated, the results being similar to those observed in clouds. The effect of turbulence in creating low stratus cloud or fog, the growth in depth of the latter, and the changes in level of the base of the stratus, are discussed. R. S. R.

2494 551.582.3

Climatological data. GRAY, R. W. *Climatol. Data, W. Indies*, 20, *pp.* 81–88, *Nov.*, *and pp.* 89–96, *Dec.*, 1940.

2495 551.582.3

Climatological data. GRAY, R. W. *Climatol. Data, W. Indies*, 21, *pp.* 41–48, *June*, *and pp.* 49–56, *July*, 1941.

See Abstr. 2489 551.585.7 : 551.506.3

See Abstr. 2487 551.591 : 551.501

2496 551.593.9 : 550.342

Luminous phenomenon accompanying the Cyprus earthquake, January 20, 1941. AZIZ, A. *Nature, Lond.*, 149, *p.* 640, *June* 6, 1942.

2497 551.594.221 : 621.315.1 : 621.316.93 : 621.3.015.5

Lightning investigation on 132 kV transmission system of the American Gas and Electric Company. GROSS, I. W., AND LIPPERT, G. D. *Trans. Amer. Inst. Elect. Engrs*, 61, *pp.* 178–185, *April*, 1942.—[Abstr. 1159 B (1942)].

2498 551.594.221 : 621.315.1 : 621.316.93 : 621.3.015.5

Lightning investigation on Wallenpaupack–Siegfried 220 kV line of Pennsylvania Power and Light Company. BELL, E., AND PACKER, F. W. *Trans. Amer. Inst. Elect. Engrs*, 61, *pp.* 196–206, *April*, 1942.—[Abstr. 1160 B (1942)].

2499 551.594.221 : 621.315.1 : 621.316.93 : 621.3.015.5

Lightning investigation at high altitudes in Colorado. ROBERTSON, L. M., LEWIS, W. W., AND FOUST, C. M. *Trans. Amer. Inst. Elect. Engrs*, 61, *pp.* 201–208, *April*, 1942.—[Abstr. 1161 B (1942)].

2500 551.594.221 : 621.315.1 : 621.317.3 : 621.3.015.5

The measurements of lightning voltages and currents in Nigeria (Part 2, 1938-1939). PERRY, F. R., WEBSTER, G. H., AND BAGULEY, P. W. *Rep. Brit. Elect. Allied Industr. Res. Assoc., Ref. S/T 29a. J. Instn Elect. Engrs*, 89, *Part II*, *pp.* 185–203; *Disc.*, 203–209, *June*, 1942.—[Abstr. 1162 B (1942)].

2501 551.594.25

Electricity of cloud and rain. CHALMERS, J. A. *Nature, Lond.*, 149, *pp.* 659–661, *June* 13, 1942.—The author discusses the electrical phenomena associated with continuous rain, as distinct from rain deposited by thunderclouds [see Abstr. 2006 (1942)]. The problem is to find a mechanism which will produce positively charged rain and a negative potential gradient. The ice-friction process of charge separation will give a negative potential gradient in which falling raindrops can acquire a positive charge by Wilson's influence mechanism. Observations of snowfall support this view, but are irreconcilable with Eiffel Tower observations of potential gradient. A series of experiments is suggested for investigating this apparent anomaly. A. HU.

VARIOUS SUBJECTS

See Abstr. 2294–2298 612.85 : 534.7

See Abstr. 2336 66.041 : 536.33

See Abstr. 2335 666 : 536.244

See Abstr. 2451 667.2 : 541.182

See Abstr. 2405 669.3 : 548 : 539.382

See Abstr. 2396 677.13 : 541.182.051.3 : 539.216.1

See Abstr. 2437 77 : 541.135.85

See Abstr. 2441 77 : 541.141.5